DECEMBER 1955

WORLD PETROLEUM

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Mention mud valves to anyone, anywhere, in the drilling business —most likely they'll say they use Cameron FLEX-SEALS, the tough valves for abrasive service. The FLEX-SEAL has no thin sections to be damaged by rough handling, no delicate adjustments and the sealing surfaces will take an unbelievable beating. Incidentally, the renewable resilient seat is non-extruding—it is retained by a shoulder on the gate, the only such design available. Naturally, this means longer life and fewer replacements. The exclusive swiveling feature makes it a life-long friend to anyone who has tried to make up a tight manifold with ordinary connections.

Like thousands of other operators, you probably enjoy these advantages now. If not, give FLEX-SEALS a try and see why they are on more rigs than any other mud valve in the world today.

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McCullough® REPORTS TO THE OIL INDUSTRY

Service
Anywhere Anytime

New Services • • • New Tools • • • New Methods • • • Outstanding Results

Simultaneous Gamma Ray Neutron Log Cuts Rig Time

Only 3½ hours were required to log 4,742' with McCullough's simultaneous logging equipment. Gamma Ray and Neutron Curves and a collar log were obtained on the one run, logging the interval from 7,500' to 12,242' in a Mississippi oil well. 5½" O.D. 20 lb. casing had been set to bottom and hole was full of mud.

McCullough's simultaneous logging equipment is available in an increasing number of service areas. Ask your nearest McCullough Branch for details.

McCullough Radiation Well Log Picks Up Four Foot Pay Zone..... Glass Jets Perforate for 240 B/D

A fine example of the accuracy of the McCullough Radiation Well Logger in locating, defining and interpreting the nature of a thin productive zone so that it could be perforated for maximum production, has just been reported from a Kansas oil field.

This was a new well. 5½" O.D. 14 lb. casing had been set to bottom. McCullough ran a Radiation Well Log obtaining Gamma Ray and Neutron curves and recording a simultaneous collar log.

The log revealed a thin, four foot zone at 3856' and indicated that it was productive. The interval was shot from logging curves and collar log measurements with McCullough's 4" O.D. Super Casing Glass Jets in Steel Strip Carrier, four holes per foot. Total logging and perforating time was only three hours.

After perforating, the well had a good show of oil. Zone was treated with acid and made 240 barrels per day on test, which was a very good well for the field.

The McCullough Radiation Well Logger is the most accurate, reliable and efficient logging instrument available. It has greater stability, provides more detail and assures more accurate quantitative interpretation.

Because of the extreme efficiency of the scintillation counter in detecting radiation and because of its very short length, it is possible to log beds as thin as 12" with clarity and accuracy.

Whether the pay zone be thick or thin, the simultaneous recording of a collar log means placing the perforations exactly where they are wanted . . . fully covering the productive formation.

McCullough Log Finds Ten Feet of Pay Behind Casing

Sixteen Standard Casing Glass Jets Shot in 10' of Cased Off Pay Zone Increase Production from 5 B/D to 30 B/D

Many times the McCullough Radiation Well Logger has been instrumental in turning a poor producer into a profitable operation. While this Oklahoma well was a small producer even at its best, the 500% increase in production gained through the use of McCullough Logging and Perforating Services meant the difference between loss and profit.

The operator had set 4½" O.D. 9.5 lb. casing on top of the pay zone. The interval was treated but the resulting 5 barrels per day of production was considerably below the average for the field.

McCullough was called to run their Radiation Well Logger. Gamma Ray and Neutron curves were obtained along with a simultaneous collar log. It was found that 10' of pay zone lay behind the casing at approximately 1645'.

Interior of McCullough Radiation Well Logging Truck showing electronic instrumentation, controls, recorder, etc. At this panel down-hole information is evaluated and recorded with extreme accuracy.

Sixteen shots were fired in the 10' interval by a McCullough Standard Casing Glass Jet Perforator with Steel Strip Carrier. The well is now making 30 barrels per day—a good well for the field. Total time on the job for both logging and perforating was one hour, twenty minutes.

As a result of the success of this job the operator is now logging and perforating all his wells in the area.

It always pays to call McCullough. You can be sure of exactly locating and defining potentially productive formations. You can be sure of deep, uniform penetration of the pay zone by the "world's hardest shooting perforators."

Technical Article Available

Copies of a technical article titled "Application of Radioactive Isotopes in Water Flood Operations" are available on request.

Write to McCullough Tool Company, 5820 South Alameda Street, Los Angeles 58, California.

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HOUSTON
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INDIA—During the Indian Railways Centenary Exhibition in 1953, visitors to the Caltex stall were impressed with exhibits and literature showing 100 years of railroad development in India. Today, Caltex railroad lubricants and fuels play an important part in maintaining better freight and passenger service . . . assure dependable operation, lower maintenance costs.

ENGLAND—Another Caltex tanker slips down the ways to join her sister ships in transporting vital crude oil and finished petroleum products to ports and markets of the free world. In commissioning these tankers and training their crews, Caltex gives employment opportunities to many . . . helps strengthen England's economy.

EGYPT—Transportation facilities in the principal cities of the "Land of the Pharaohs" are strictly up to date. To motorists and fleet owners, modern Caltex service stations—like this one in Cairo—offer the latest in automotive products . . . and the efficient service that brings back old customers and attracts a constant flow of new friends.

CALTEX serves the people of 67 lands

In 67 lands, across half the world, through such developments as these, Caltex is able to supply better fuels and lubricants for industry, for agriculture, and for motoring millions. These require a continual investment of funds and skills, backed by a faith in a better future for free nations.

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Washington PIPE LINE

By Joseph B. Huttlinger

An effort to change the basic formula as to the amount of crude oil and residual fuel that may be brought to the United States is shaping up as the next major step in the matter of oil imports to the United States.

The effort would start, probably at public hearings, which are to be held into oil imports, unless oil importers on their own cut back to levels recommended by Dr. Arthur S. Flemming, director of defense mobilization. The hearings could be held this year, but probably won't be until next year.

The basic formula was set forth last Feb. 26, in the report of a Cabinet Committee of which Dr. Flemming is the chairman. The formula is that crude oil imports in the future must be held to the same ratio to domestic production as they held during 1954. The same formula applies to residual fuel oil.

Legislation added to the Reciprocal Trade Agreements Act last July, backed up the effort to hold the line on imports by giving President Eisenhower the authority to take action as needed to crack down on imports if they became excessive. By implication, the legislators indicated the Cabinet committee formula is the test.

Under the law, and under the formula, Dr. Flemming now has dispatched three letters to oil importing companies asking them for figures. The latest letter on October 29 asked them to cut back imports by seven percent in the six months ending next March 31. Imports from Canada were excepted as "a special case" and from Venezuela from the standpoint of defense needs of the U. S. Thus, Middle East operators would bear the whole force of the cutback. Residual fuel oil imports, once above the formula levels, now are in line, Dr. Flemming told the companies.

Dr. Flemming explained that under the measuring stick he is using, the formula, oil imports are too high; they are hurting U. S. industry and thus the U. S. national security. At the same time, he painted a picture of the U. S. industry as booming, all but inviting someone to come in and ask for changes in the formula.

He said, "Responding to a record total demand for crude oil nearly seven percent above last year, total domestic production of crude oil during January-September, 1955, exceeded 1954 by nearly six percent despite a slight decline on the West Coast.

"East of the Rockies domestic production was seven percent above 1954. Exploratory activity, as indicated by drilling has been 12 percent above 1954, while well completions were over seven percent higher.

"The average price of crude oil at the well has remained stationary during 1955 at the postwar peak level of $2.82 per barrel. Stocks of crude oil in Sept. 30, 1955, were down 20 million barrels or at the rate of 55,000 b/d from September 30, 1954.

"While imports of crude oil during January-September 1955 were 14 percent above the same period in 1954, the increase of 105,000 b/d represents an excess of 76,200 b/d over the amount allowed by the committee recommendation, or less than one percent of total U. S. crude oil demand in the same period."

What this seems to mean is this: While crude oil imports are higher than the formula, the U. S. domestic industry is going strong, according to most measures. Therefore, the formula may be wrong if it says the U. S. industry is suffering. As a result, the formula itself may properly be the subject of close study.

Naturally, oil importing companies would propose a loosening of the formula, to allow more crude oil and residual oil into the United States. They may propose, further, special treatment for Canadian and Venezuelan oil. They may propose a number of detailed revisions. On the other hand, U. S. oil producers will try to defend the formula as proper. A few of them, in fact, may claim it allows in too much oil.

At a press conference disclosing the Cabinet Committee formula last February, members of the Cabinet made clear that the formula itself is subject to change. This was explained by Secretary of the Treasury George Humphrey, Under-Secretary of State Herbert Hoover, Jr., and Dr. Flemming. A debate about changes in the formula may come along, at the same time U. S. oil and coal interests step up the pressure on Congress next year for hard and fast action to slow down oil imports.

Government Controls May Extend to Crude

U. S. crude petroleum and natural gas producers finally are feeling the sharp bite of federal price and other controls.

In fact, in two decisions during October, the U. S. Federal Power Commission threw out a broad hint that it will impose "cost-plus" controls. If the commission does this over gas, the control could spill over into crude oil production as well.

The chief reliance of the producers, therefore, is for legislation from the U. S. Congress removing or easing controls the commission now has over independent producers of gas. By and large, the independent producers also produce crude oil.

The U. S. House of Representatives passed legislation last year to ease up the FPC controls, and the matter is before the U. S. Senate. The prospect is a majority of the Senate will vote for the legislation, but there may be changes. If so, the measure would have to go back to the House, where the vote was by a margin of only six. This being so, the final enactment of the legislation is regarded as touch and go.

The cost-plus decisions came from the commission in two almost identical decisions involving Union Oil Co. of California, Sun Oil Co., and others. The companies had tried to hike their rates to Transcontinental Gas Pipe Line Corp., Houston. The companies explained they had contracts providing escalation, favored nation contracts, and "bonafide offer" provisions. The commission rejected these reasons.

Then, the companies said the higher rates would be in line with rates of 138 other gas producers in the area, popularly 17 cents per mcf. The commission said this is not proof enough. The rates, the commission said, must be "just and reasonable."

How does a producer prove "just and reasonable"? The commission would not say, except to explain: "The independent producers which are applicants herein are under the same burden as interstate pipe line companies to justify any proposed rate increases, even if their operations may differ."

What this seems to mean is that the producers must use the same proofs of just and reasonable as a pipe line company. And a pipe line company proves a case by showing its costs, and then showing its revenues, and then saying it needs so much more revenue to make a fair return, generally six percent.

For gas producers, this is intolerable. They never have shown their costs to government, or their revenues, and they don't want to now. Yet, unless the new legislation passes, they may face this prospect from here on out.

Oil Import Firms

How many firms in the U. S. import crude oil and products from abroad? An exact count is hard to come by, but the government now has a list of 40 companies which it believes are importers.

Forty companies have received letters from the Office of Defense Mobilization asking them to hold the line on oil imports under new U. S. policy and legislation, including:

Asiatic Petroleum Corporation
Atlantic Refining Company
Cities Service Company
Eastern States Petroleum Company
Gulf Oil Corporation
Phillips Petroleum Company
Shell Oil Company
Shell Caribbean Petroleum Co.
Sinclair Refining Company
Socony Mobil Oil Company, Inc.
Southwestern Petroleum Company
Standard Oil Co. of California
Standard Oil Co. of N. J.
Sun Oil Company
The Texas Company
Tide Water Associated Oil Company
McBride Oil Company
Crown Central Petroleum Corp.
Douglas Oil Co. of California
First National Oil Corporation
Hess Fuel Company
International Refineries, Inc.
Lake Superior Refining Co.
Malco Refineries, Inc.
Mohawk Petroleum Corporation
Old Dutch Refining Company
Paragon Oil Co., Inc.
Republic Oil Refining Company
Richfield Oil Corporation
Southeastern Oil, Inc.
Southwestern Oil & Refining Company
Steuart Petroleum Company
Wilshire Oil Co., Inc.
Woodley Petroleum Company
Northwestern Refining Company
Great Northern Oil Company
Aurora Gasoline Company
Leonard Refineries, Inc.
Wisconsin Oil Refining Co., Inc.

Elmer Batzell, Washington, D. C., attorney, began distributing to oil company officials during November copies of the new regulations governing oil and gas operations in Guatemala.

The code and the regulations, according to Batzell, provide "a complete regulatory system under which private enterprise can engage in petroleum activities in Guatemala."

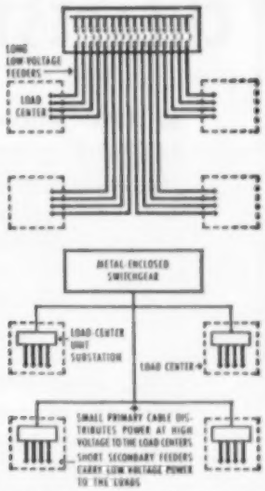
They lay out the ground rules for applications, submission of maps, hearings, many of which shall be public, keeping of records by the government, overlap of applications, taxation, depletion allowance and intangible drilling costs and the like. Mr. Batzell, who helped in the draft of the code and the regulations, explained: Under the Petroleum Code and the new regulations applicants for petroleum rights in Guatemala may file applications at any time until 6:00 PM, of Nov. 23, 1955, and enjoy equal priority with other applicants filing before the deadline. In the event of any conflicts the Code provides procedure for their resolution. After the period of equality the date of the filing of applications will determine their priority in the event of overlap of applications.

Applications may be filed for rights relating to exploration for, and exploitation of petroleum and to refinery and pipe line facilities in Guatemala. The Petroleum Code enacted on July 7, 1955 supplemented by the new regulations provides a complete regulatory system under which private enterprise can engage in Petroleum activities in Guatemala.

LOAD CENTER DISTRIBUTION KEY TO GREATER PROFITS

THE OLD WAY

THE LOAD-CENTER WAY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METAL-ENCLOSED SWITCHGEAR
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LOAD CENTER
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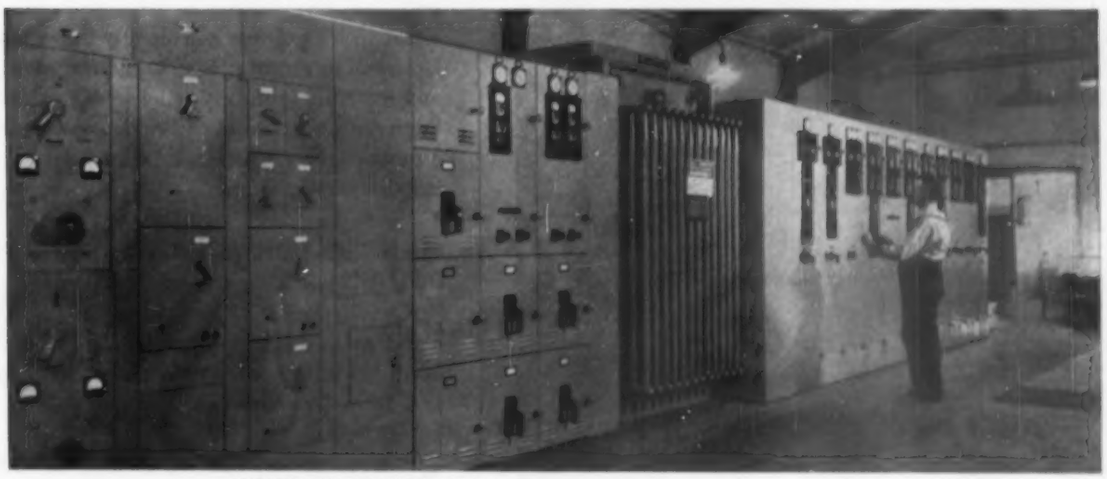
LOAD CENTER DISTRIBUTION HAS TWO DISTINCTIVE FEATURES THAT SAVE YOU MONEY

1. Short secondary feeders to points of use, from small unit substations in electrical load center locations where power is stepped down to utilization voltage. Besides using less expensive secondary equipment and less cable, this system cuts line losses. Lower cost secondary switchgear is possible because of lower short circuit current.

2. Initial distribution of power at high voltages of 2.4 to 13.8 kv. Utilities have long recognized the inherent economy of delivering power at high voltages. Where total load cannot be met by a single small substation (1500 kva), two or more small load-center substations are used (rated 200 kva and up).

One Source Buying Means Greater Integration

With this modern load-center distribution system, basic units are standardized. Planning and ordering are simplified . . . installation is quick and easy.



TYPICAL UNIT SUBSTATION Complete metal-clad switchgear equipment showing, l. to r., centralized motor control, secondary switching air circuit breakers, Pyranol filled transformer, and incoming line section with metal-clad air circuit breakers and metering compartments.

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G-E SWITCHGEAR insures strength and safety. Because it is standardized, all component parts are safely and conveniently accessible to give simpler operation. New flame-retardant material insulates circuit breaker, which has the maximum number of parts interchangeable among breakers of various ratings.

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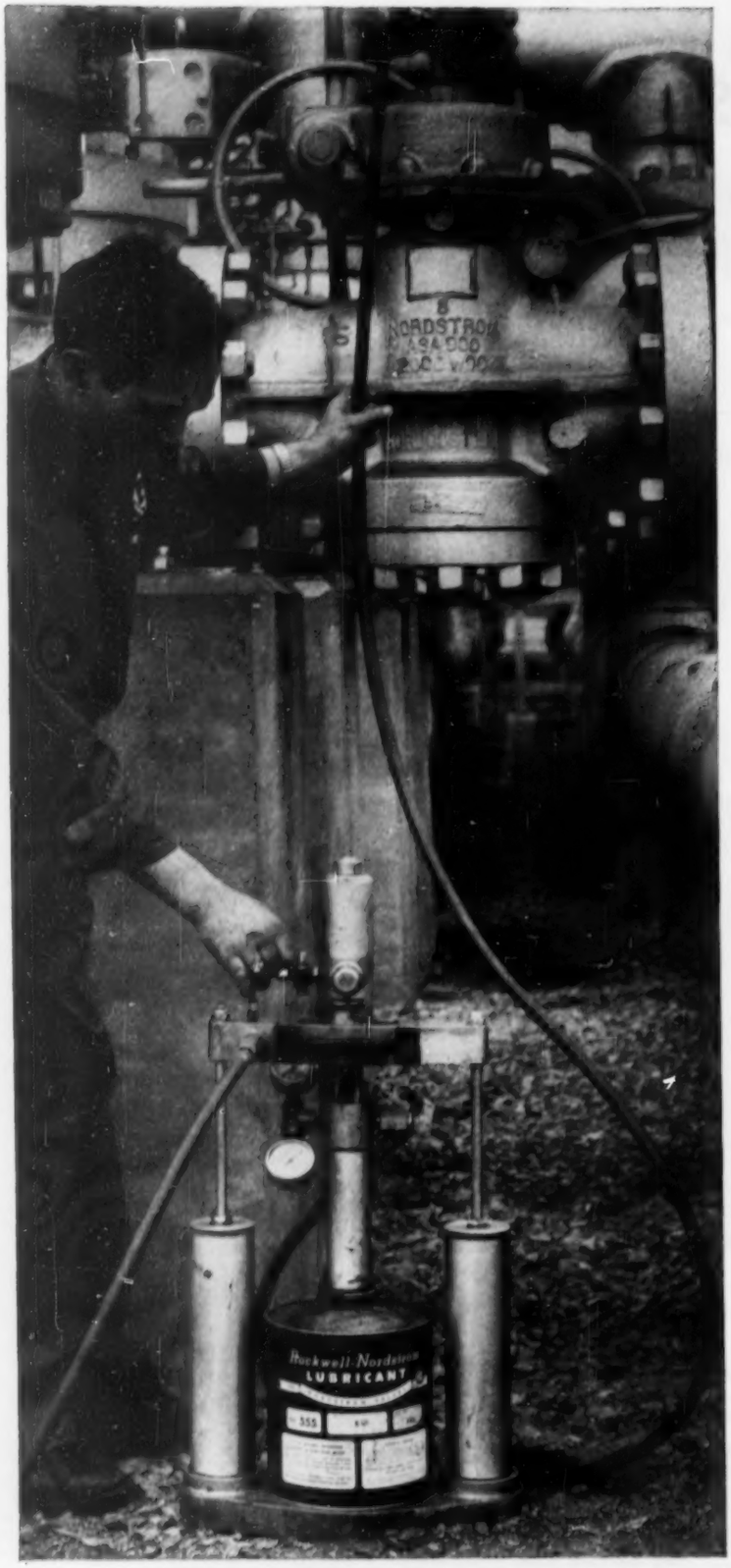

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Costly down time is practically eliminated because lubrication stops trouble before it starts. Lubricant also hydraulically jacks the plug assuring *instant*, quarter turn operation.

● **LUBRICATION IS FAST . . . EASY**—Nordstrom and Audco valves *can be lubricated while in service*—either with a pressure gun directly through the standard Rockwell lubricant fitting, or by unscrewing the fitting and inserting lubricant "sticks." The time it takes to lubricate a Nordstrom and Audco valve—whether once a day or once a year—is an *investment* in trouble-free, long-life valve service.

● **LUBRICATION PENNIES SAVE MAINTENANCE DOLLARS**—A few cents worth of lubricant buys three things: 1. *new seats* (renewing the lubricant is like reseating an ordinary valve) . . . 2. *smooth, dependable* operation and 3. *savings* in lower repair, replacement and down time expenses.

● **GENUINE NORDSTROM and AUDCO LUBRICANTS** are the result of 40 years of production "know-how" and field testing by the pioneer lubricated plug valve manufacturer. It is wise economy to use the lubricants that have been *proved* best.

● **40 YEARS OF PERFORMANCE PROVE** that Nordstrom and Audco valves are the most economical valves you can buy for *any* service. *For every two dollars users spend on Nordstrom and Audco valves, they spend less than one penny for repair parts!*

Whatever your needs, there is a Nordstrom and Audco valve that will do the job with more trouble-free dependability and at lower cost per year than any other valve you've ever used. And the first cost is no more (and often less) than the cost of ordinary valves! Write today for more information.

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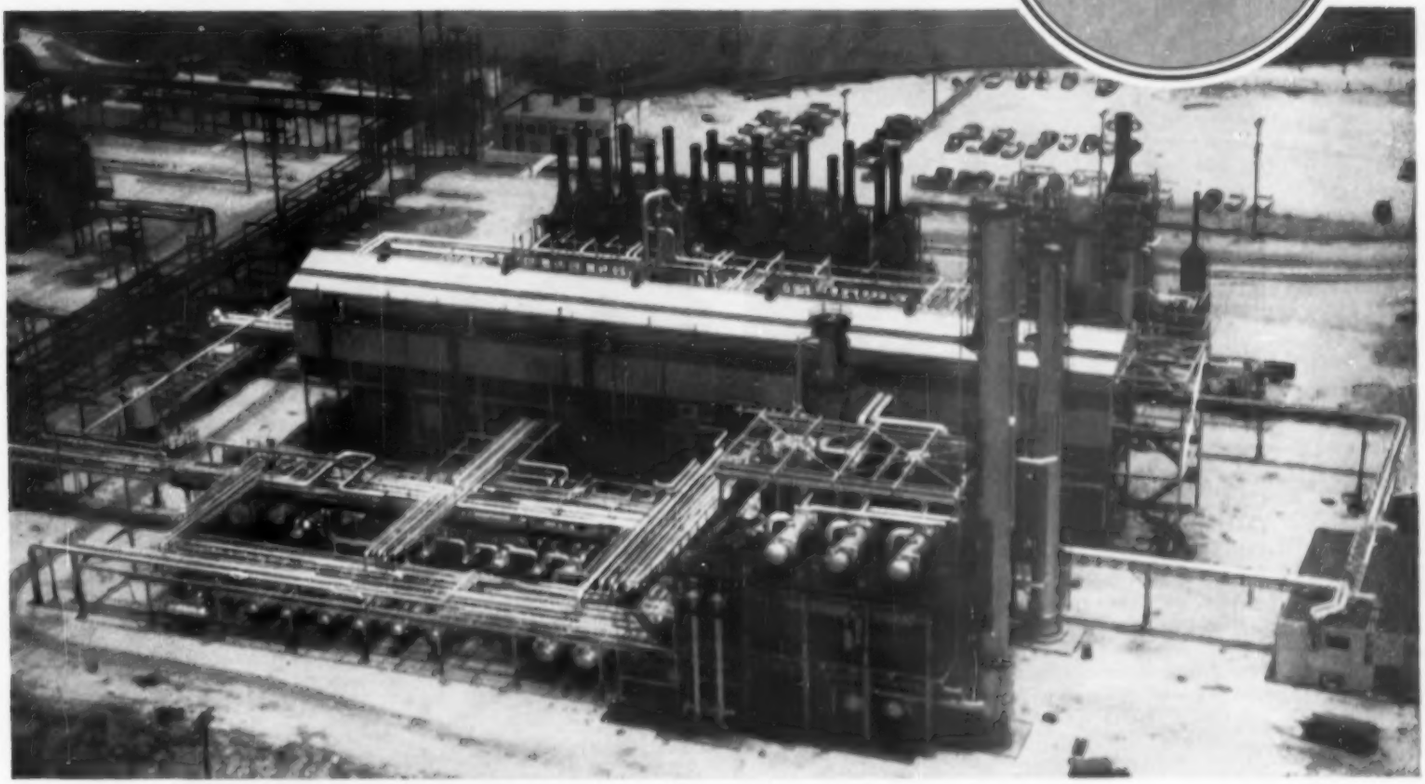

Gulf Oil Corporation's new No. 2 Ethylene Plant at Port Arthur, Texas, designed and constructed by Stone & Webster Engineering Corporation, proves again that — in *any* plant — performance is the payoff.

Stone & Webster's pyrolytic cracking process, commercially proven on feedstocks ranging from light hydrocarbons to heavy gas oils, is used in the Gulf plant designed to produce ethylene from ethane and propane.

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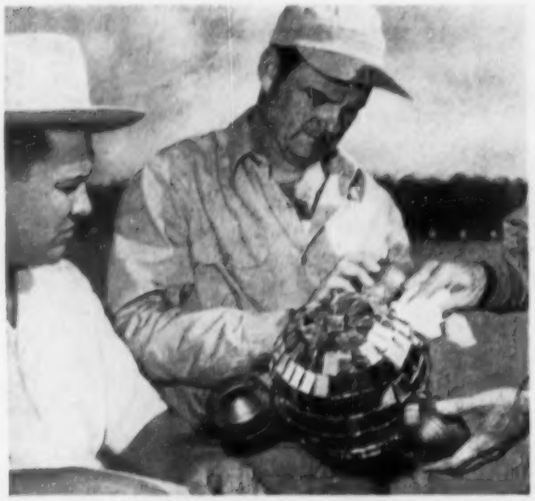
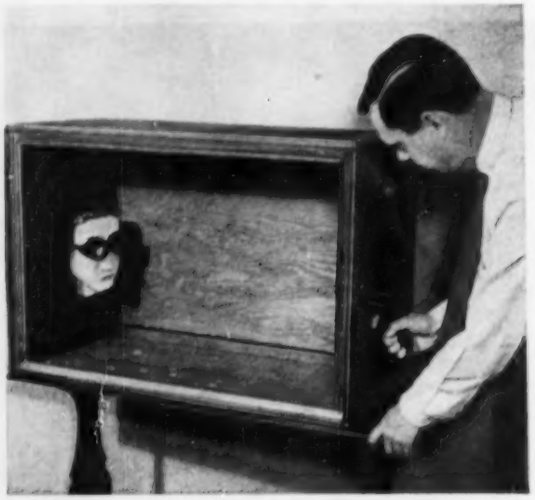
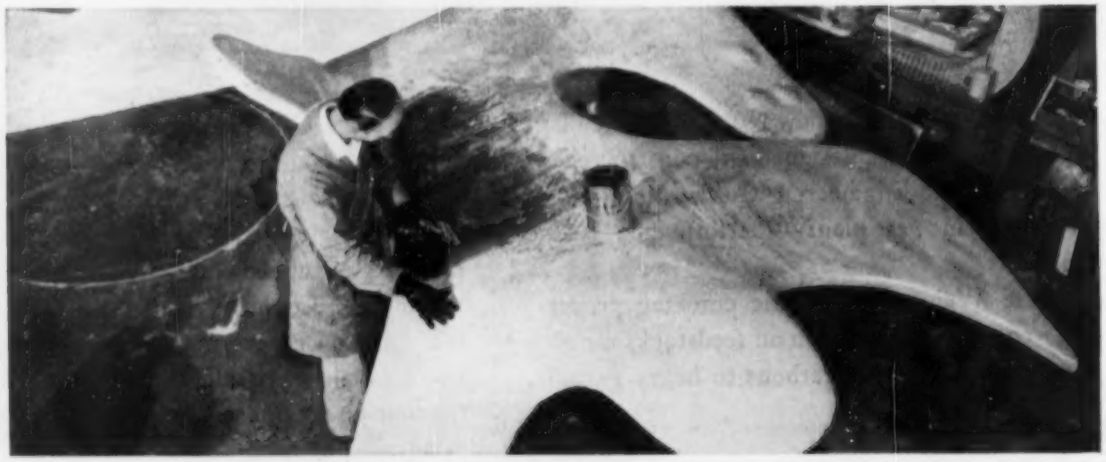
A PICTURE ROUND-UP OF SOME ACTIVITIES THAT MADE NEWS OUTSIDE THE PETROLEUM WORLD



CRYSTAL BALL. To "zero in" on off-shore drill sites with pin-point precision, Shell engineers came up with this spinning, mirrored marker. The "crystal ball" rotates atop a buoy in an off-shore exploration area. Ashore, surveyors on two eighty-foot towers spot the marker by its dancing reflections and "fix" the new drill site. Shell's efficient handling of such everyday problems means faster development of off-shore oil exploration — a vast new reserve for America to count on.



SAFETY IN NUMBERS. Safety at Shell is a full-time job. In this demonstration a .22-caliber bullet is fired into the safety lens of protective goggles. Even with a direct hit, the safety lens will not shatter! Recently, safety-conscious Shell people at the Wilmington-Dominguez Refinery, Calif., amassed a record of almost 4,000,000 man-hours without a lost-time accident. Records like this mean safer working conditions and lower cost, better quality products for everybody.



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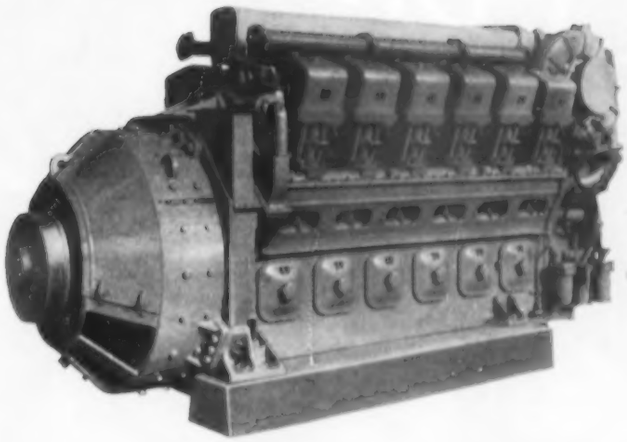

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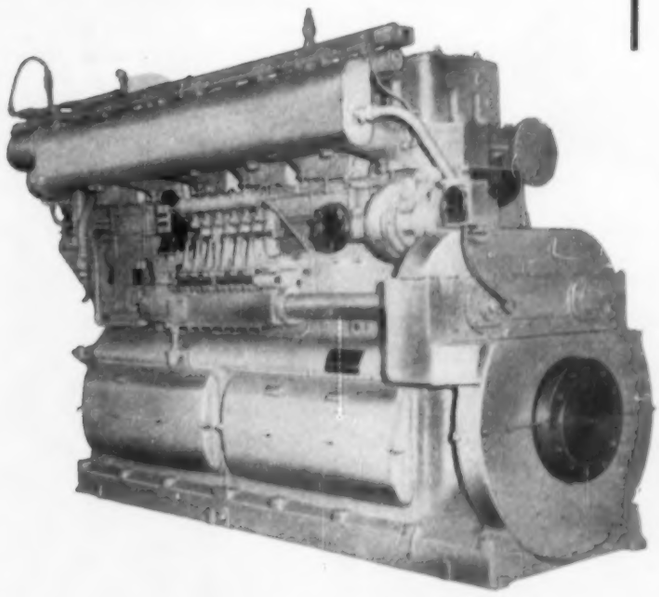

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Always to the fore in improved petroleum products, Veedol still leads in the swing to all-weather motor oils. In the East . . . in the West . . . on modern highways, in lonely deserts, on icy mountains, new Veedol 10-30 is bringing the benefits of *highest octane performance, greater gasoline mileage* to motorists the world over.

New Veedol 10-30 is the culmination of over three quarters of a century of petroleum progress. Building pipelines, sinking wells, building refineries, the producers of Veedol have grown from a tiny enterprise in America's first field to a major oil company with producing facilities in a dozen different states and distributing centers throughout the world.

The experience, the reputation built over the years is back of new Veedol 10-30. Use it with confidence in your automobile!

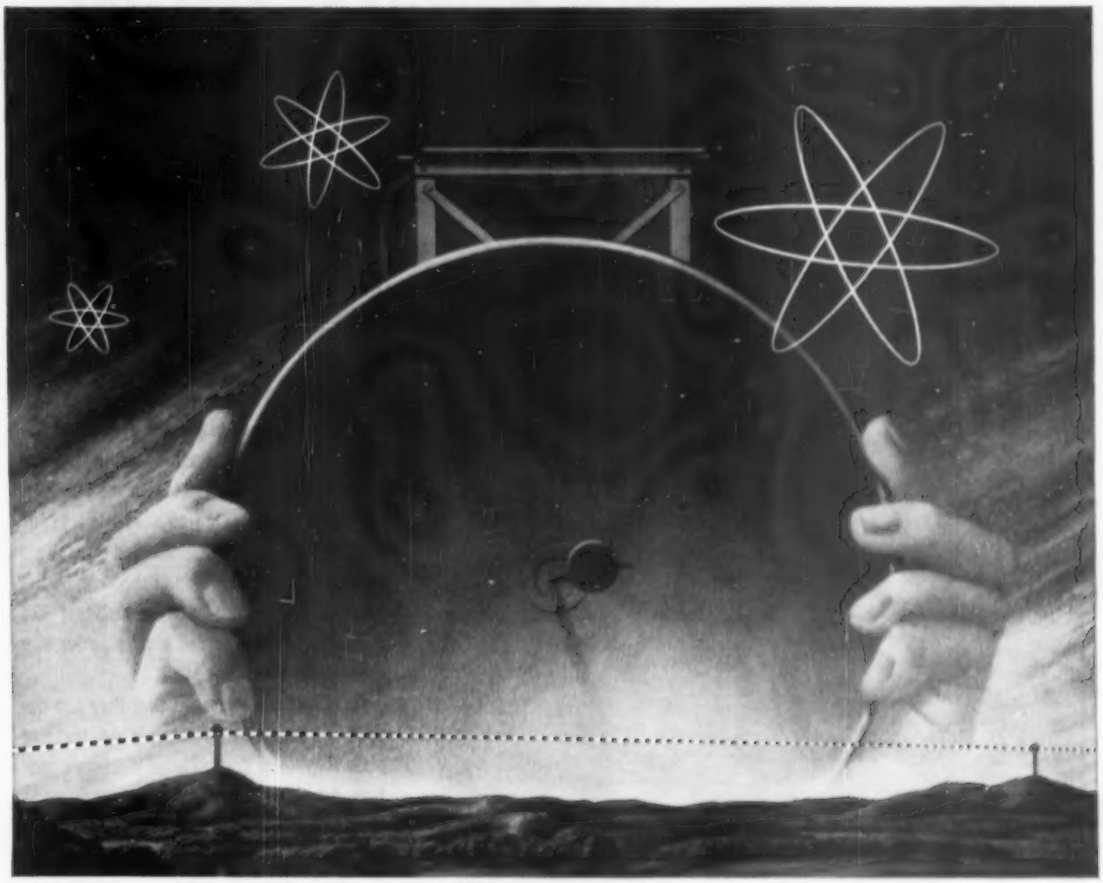
TYDOL

TIDE WATER ASSOCIATED OIL COMPANY

San Francisco New York Houston Tulsa

FLYING A TIRES

FEDERAL MICROWAVE—"*CERTIFIED BY A WORLD OF RESEARCH*"



Before buying microwave today...look at tomorrow!

What new types of applications will industry expect of microwave communication in the years ahead?

This is a vital question for microwave buyers in this electronic and atomic age, when science, industry, and communication are moving forward so rapidly. Before the final decision is made there should be assurance that microwave techniques will keep in step... always be ready to *interwork with progress!*

With *Federal* Microwave this assurance is an inherent part of the system... and to a unique degree. Working constantly in laboratories and microwave factories in many countries are hundreds of scientists and engineers of International Telephone and Telegraph Corporation... finding new applications for microwave... advancing the capabilities and performance of associated equipment, such as telephone, carrier, and VHF mobile radio.

IT&T's never-ending activity provides the greatest possible protection for today's microwave investment... the finest assurance that the applications of tomorrow will be met by *Federal* Microwave... the system whose future is *"Certified by a World of Research!"*

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In Canada: Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., New York

NEW HIGH-TEST PIPELINE UNDER WAY FROM NEW MEXICO TO THE PACIFIC NORTHWEST

A giant new artery of steel is growing in the West—the 1422 mile Pacific Northwest Pipeline—to carry natural gas from the San Juan Basin in New Mexico to serve the great Pacific Northwest. Consolidated Western's new Utah plant—centered in the "hub of the West"—is the key source of high-test 22" and 26" diameter welded steel pipe for this great project.

Pipeliners have learned that they can depend on Consolidated Western's high-test line pipe. They know Consolidated Western's controlled quality manufacturing results in the high strength, ductility, good welding properties, uniform diameter and wall thickness, that assure ease of installation plus maximum service and safety per ton of steel.

Combining quality control and 100 years of engineering and fabricating leadership, Consolidated Western Steel division United States Steel Corporation, is your primary source of supply for 20"-36" high-test line pipe.

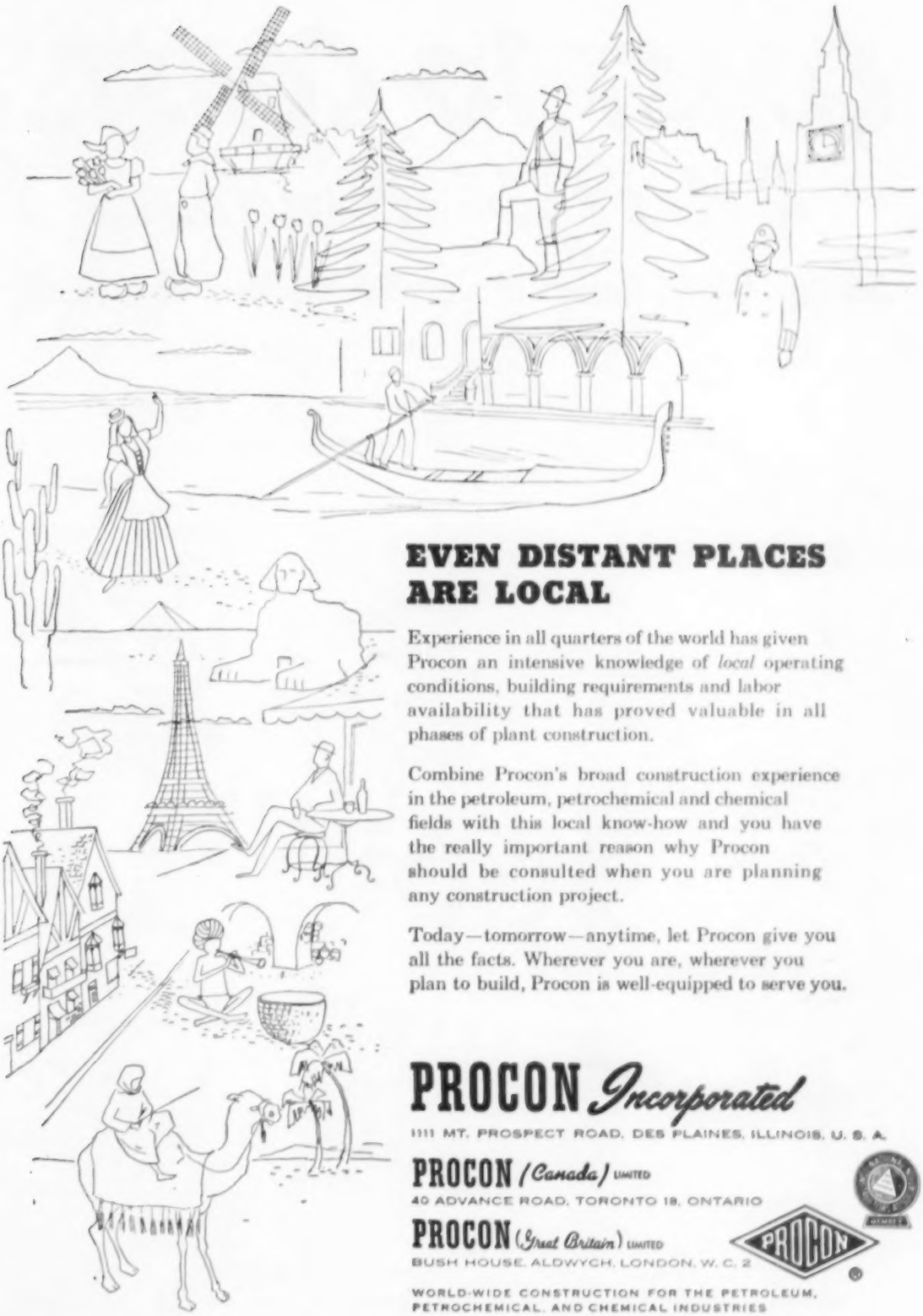
Please direct inquiries to: Consolidated Western Steel, Pipe Sales Office, P.O. Box 2015, Terminal Annex, Los Angeles 54, Calif.

CONSOLIDATED WESTERN STEEL

Sales Offices: Los Angeles, San Francisco, Fresno, Bakersfield, California; Phoenix, Arizona; Seattle, Washington.

DIVISION

UNITED STATES STEEL



EVEN DISTANT PLACES ARE LOCAL

Experience in all quarters of the world has given Procon an intensive knowledge of *local* operating conditions, building requirements and labor availability that has proved valuable in all phases of plant construction.

Combine Procon's broad construction experience in the petroleum, petrochemical and chemical fields with this local know-how and you have the really important reason why Procon should be consulted when you are planning any construction project.

Today—tomorrow—anytime, let Procon give you all the facts. Wherever you are, wherever you plan to build, Procon is well-equipped to serve you.

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COAST TO COAST..

4 Hrs., 24 Minutes—

Another World Record Made with the Help of Mobiloil

In the Air—1954—Joe DeBona, flying a piston-engine Mustang, covered the distance from Los Angeles to New York in 4 hrs., 24 min., 7 sec. —a new transcontinental record for conventional aircraft!

On Land—1947—John Cobb, driving his giant 2000-hp car, streaked across Utah's salt flats at an amazing record average speed of 393.82 mph!

On Water—1952—Stan Sayres' famous Hydroplane—Slo-Mo-Shun IV—averaged 178.49 mph on Lake Washington to smash all speed records for propeller-driven water craft!

New Mobiloil Special Powers as it Protects!

These two great products—Mobiloil and Mobiloil Special—are the world's most famous lubricants. *Mobiloil* is first choice with more motorists than any other brand. And Mobiloil *Special* already outsells all other year-'round motor oils *by far*.

SOCONY MOBIL OIL COMPANY, INC.

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MAGNOLIA PETROLEUM COMPANY

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Makers of

Mobiloil—World's Largest-Selling Motor Oil

Mobiloil Special—America's Most Popular Year-'round Motor Oil

DU PONT

PETROLEUM CHEMICALS DIVISION NEWS

DU PONT

December ★ One of a Series of Interest to the Petroleum Industry ★ 1955

Assistant Director of Sales

W. SAMUEL CARPENTER, III, was recently named assistant director of sales for the Du Pont Petroleum Chemicals Division.

Just prior to this assignment, Mr. Carpenter was director of manufacturing for the Cellulosics Division of the Textile Fibers Department. He joined the Du Pont Company in 1938 as an industrial engineer in the Engineering Department. In 1944, he was assigned to construction operations at Hanford, Washington, where the government's atomic energy project was built and operated by Du Pont during World War II.

When he returned to Wilmington in 1945, he was assigned to the Construction Division of the Engineering Department. The following year he became manager of that department's Planning Division and later manager of its Industrial Engineering Division.

In 1947, Mr. Carpenter was transferred to the Rayon Division as assistant to the director of production. And in 1949, he became assistant manager of "Cordura" high-tenacity rayon yarn sales. Then he was named assistant manager of the Rayon Department Planning Division in 1950.

Mr. Carpenter is a graduate of Princeton University in chemical engineering.

Construction under way on new Du Pont California tetraethyl lead plant

Approximately 200 local California construction workers are now busy erecting a new Du Pont tetraethyl lead manufacturing plant on a site near Antioch, California. Also completely integrated on the same site will be facilities for manufacturing Du Pont "Freon" refrigerants, sodium, ethyl chloride, trichlorethylene and perchlorethylene.

Architect's sketch of Du Pont's new integrated plant under construction at Antioch, California.

The official ground-breaking took place on August 24. Immediately following, the engineering and construction crews moved on to the site—which is in the Diablo Valley, approximately two miles east of Antioch on the San Joaquin River. Since then the work has been progressing at a rapid pace and the new TEL plant is expected to go on stream in 1956.

The fast-growing TEL requirements of the West Coast petroleum industry prompted the Du Pont Company's decision to build the plant in California. The convenient location of the Antioch site makes it readily accessible to both water and rail transportation.

Latest improvements

The new West Coast plant will house the most modern tetraethyl lead manufacturing facilities in the world. It will not only employ the new continuous process developed by Du Pont at the company's Chambers Works plant in

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

OVER

PETROLEUM CHEMICALS DIVISION
NEWS

CONTINUED

California Plant

New Jersey, but will also include many new refinements which make this modern process more efficient than ever.

Why the drilling rig?

Did you ever hear of anyone making a 7,000-foot hole in the ground with an oil drilling rig – yet hoping they *wouldn't* strike oil? That's what the Du Pont Company did on the Antioch site.

The hole will provide a means for disposing of brine wastes without any possibility of contamination of surface water or subterranean water resources. The well was "brought in" by the Brown Drilling Company in August, the first part of the new project to be completed.

Integrated production

Although the original Du Pont plan called for only the TEL and "Freon" manufacturing facilities at Antioch, the additional facilities for making other chemicals will add greatly to the efficiency of the over-all unit. This is because sodium and ethyl chloride are essential ingredients in the manufacture of tetraethyl lead.

Besides supplying intermediates for

Continued—middle of next column

TEL, the plant will also produce metallic sodium for Du Pont customers on the West Coast. It is widely used in metal descaling, especially for stainless steel. The trichlorethylene will go chiefly to West Coast aircraft and metal fabricating industries for degreasing metal parts. The dry cleaning industry is the chief consumer of perchlorethylene.

Due to the rapid expansion of West Coast industry, there is a definite need for the new California plant. And its establishment will enable Du Pont to give its West Coast customers the utmost in delivery service.

The three primary raw materials needed by the plant – lead, propane and salt – will be purchased locally. Propane, made from petroleum, will be brought into the plant from nearby refineries.

Creating new jobs

When completed, the over-all Du Pont facilities at Antioch will provide production jobs for some 500 people. The majority of these will be hired locally. At the peak of construction, about 500 workers will also be employed for building the plant.

ANOTHER DU PONT MARKETING SERVICE

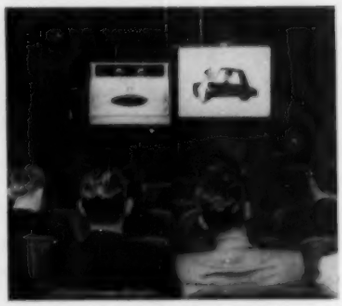
New "SELL YOURSELF" dealer training program offered

No matter how excellent the products he sells, a service station operator's success depends to a large degree on how well he sells *himself*.

But this involves *intangible* factors such as personality, friendliness, helpfulness. How, you may ask, can you impart such abilities to hundreds of individual and independent dealers? Actually the problem may not be as difficult as it looks on the surface.

To help you dramatize these factors and show your dealers how they pay off at the cash register, the Du Pont Petroleum Chemicals Division has prepared a unique 30-minute presentation. An animated, *talking* cash register acts as master of ceremonies. This is manually synchronized with a full-color animated cartoon movie.

It shows, in a very simple, easy-to-understand way, how any service station attendant can capitalize on everyday human relations. And it clearly demonstrates the selling power of personal neatness, friendly conversation and common courtesy.



The principal characters in the movie story are on-the-ball Joe Wright, a successful service station operator, and sloppy Joe Wrong, whose poor appearance and disagreeable attitude drive business away from his station. The simplicity of the story makes it unusually penetrating and convincing.

How soon would you like to make use of a "Sell Yourself" presentation in your own dealer training program? Any of our sales offices listed below will be glad to schedule it for you.

DU PONT
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PITTSBURGH, PA.—Room 510, Alcoa Bldg. . . . . Phone ATlantic 1-2933
SAN FRANCISCO, CAL.—Room 626, 111 Sutter St., Phone EXbrook 2-4230
SEATTLE, WASH.—Room 215, 4003 Aurora Ave. . . Phone MElrose 6977
TULSA, OKLA.—P. O. Box 730 . . . . . Phone LUther 5-5578
IN CANADA: Du Pont Company of Canada Limited—Petroleum Chemicals Division—80 Richmond Street West—Toronto 1, Ontario
OTHER COUNTRIES: Petroleum Chemicals Export—Nemours Bldg., 6539—Wilmington 98, Delaware

ADVERTISEMENT—Prepared for the Petroleum Chemicals Division of E. I. du Pont de Nemours & Company (Inc.)

Printed in U. S. A.

THE LAST WELD

350 miles in 5½ months!

19 days ahead of schedule in spite of 60 canal and river crossings, swamps, desert, hard rock, sand dunes, irrigated fields, crossing roads, railways and two barrages. This 16" diameter pipeline carries natural gas from Sui to Karachi.

The new £10,000,000 project, a vital artery in the progress and development of South Pakistan, and the longest natural gas pipeline in the Eastern Hemisphere, was constructed by D. & C. and William Press in association with the Morrison-Knudsen Corporation.

D. & C. and William Press Limited are associated with large-scale constructional work in the petroleum and allied fields throughout the world.

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KELLOGG
Sinclair-Baker
Reforming

Dark Horse
in the
Reformate
Race...

New Process and New Catalyst Promise New Records in Production of Low Cost, High Octane Reformates

Although the M.W. Kellogg, Sinclair-Baker process is still too new in service to provide any long-term performance data, and customers' initial findings cannot yet be disclosed, many economic advantages of this catalytic naphtha reforming process have already been firmly established. Any refiner faced with increasing octane yields from present feedstocks, or with getting high octane reformates from lower grade naphthas, will recognize the significance of the following points . . .

Quick Start-Up

Experimental operation is reduced to a minimum. One M. W. Kellogg reforming unit was started on its final test run within two weeks after the catalyst was first charged to the reactors—with octane rating and yield during this 15-day period well in excess of the guarantee.

A Regenerative Catalyst

Sinclair-Baker Platinum Catalyst RD-150 can be regenerated easily and quickly *in situ* to provide many operating cycles, each of many months duration, with negligible loss in catalyst activity. Cost of catalyst per pound in terms of barrels of reformate produced is a major economic factor of the process.

Long Catalyst Life

Sinclair-Baker regenerative catalyst RD-150 has high activity and long initial life. It has been in operation for over one year without supplementing the catalyst. 95 octane reformate can be produced for six months or longer before regeneration is required.

Octane Level

Depending on the feedstock, clear octane ratings above 90 are now being obtained commercially—with 100, and even better, a goal that is entirely feasible and economically practical. *Variability* of octane rating is the keynote of the process, permitting selection of the exact processing conditions for a given naphtha to secure optimum economic operation at all times.

Supply of Catalyst

Use of the process does not obligate refiners to buy Catalyst RD-150 beyond the first year's requirements, although a continuing source of supply can be assured. This freedom from long-term purchase and license agreements is an important consideration when deciding which is the most suitable reforming process.

Low Grade Naphtha Feeds

M. W. Kellogg's unique design permits the effective desulphurization of low grade naphthas as part of the process, and avoids corrosion and metal contamination. Kuwait naphthas thus treated, for example, can produce yields of high octane reformates only slightly lower than those for higher grade Mid-Continent feedstocks.

For More Information

Further details on M. W. Kellogg's catalytic naphtha reforming process, the Sinclair-Baker catalyst, together with some economics of both, are contained in a recent booklet, "Low Cost Production of 95 Octane Clear Reformate." Copy sent on request.

Refinery Process Division

THE M. W. KELLOGG COMPANY

225 Broadway, New York 7, N. Y.

The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corp., London

SUBSIDIARIES OF PULLMAN INCORPORATED

GOING PLACES *on the sands of time with Cities Service...*

Prehistoric monsters left no stranger trail than these geologists surveying tidal Gulf Coast sands in the search for new reserves of oil.

CITIES SERVICE
A Growth Company

Number 17 of a series

ONE OF THE MANY MARKET-PLACES FOR PETROLEUM PRODUCTS

AUSTRALIA IS BIG — nearly 3,000,000 square miles in area . . . almost as big as the U. S. A.

Yesteryear this great continent was the wasteland of the aborigine. **Today** — scarcely 150 years after being pioneered and settled, it is a nation with major industries built around gold, silver, copper, lead, and zinc . . . coal, iron and steel . . . wool, beef, and dairy produce . . . sugar, fruit, grains, wine, and processed foods . . . timber, newsprint . . . Australia's **Tomorrow** is truly bright with promise and opportunity.

Standard-Vacuum is proud of the part played by its affiliated companies in supplying the petroleum products so essential to the continued growth and development of Australia.

STANDARD-VACUUM OIL COMPANY

A name that stands for "Progress" in the East

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SOUTH PACIFIC ISLANDS • SOUTH WEST AFRICA • TANGANYIKA • THAILAND • UNION OF SOUTH AFRICA

World Petroleum feature issues 1956

604 Fifth Avenue New York City 20

EXPLORATION NUMBER

Exploration for oil and gas will be active in the international field in 1956 on recently obtained concessions in both Latin America and the Eastern Hemisphere. The annual March survey will provide a complete picture of current activities and future plans with a special section on techniques and operations in the growing field of offshore reconnaissance.

MARCH

CANADIAN NUMBER

This will be the seventh annual survey of oil, gas and petrochemical progress in Canada. Each yearly number has grown in size, interest and distribution in what has come to be looked upon as the encyclopedia of the Canadian industry's development. The May number will be distributed at the mid-year meeting of the Refining Division of the American Petroleum Institute which meets for the first time in Canada in 1956. News-stand circulation of this issue in Western Canada is substantial.

MAY

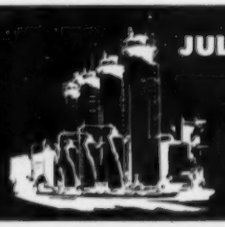
DRILLING AND COMPLETION NUMBER

The first July issue will be devoted to a study of new drilling equipment and techniques developed to enable the drilling of deeper wells. Special articles will be published dealing with methods of completing oil wells for maximum recovery by primary methods. Secondary recovery developments for stimulating production from oil fields will also be detailed.

JULY 1

ANNUAL REFINERY REVIEW

The 26th Annual Review of refining activity and technical progress will chronicle developments throughout the world with authoritative articles on current problems, improvements in processing, outstanding new construction and a full directory of world refineries with their capacities and products. *Copies of this issue go to every active refinery in the world.*



JULY 15

INTERNATIONAL SURVEY

Each September the editors of WORLD PETROLEUM present a summary of important developments in the international field with facts and statistics on operations in different countries and articles dealing with current problems affecting the industry's worldwide activities—an issue that always attracts exceptional attention. Data is given on world supply and demand and changes in shifting currents of world trade.

SEPTEMBER

A.P.I. NUMBER

Keyed to the yearly convention of the American Petroleum Institute and placed before those in attendance at the annual meeting, the November issue presents articles by leading members of the industry discussing problems of direct interest to management and operating men in all departments. It is a number that always receives close attention from men in all branches of the industry.

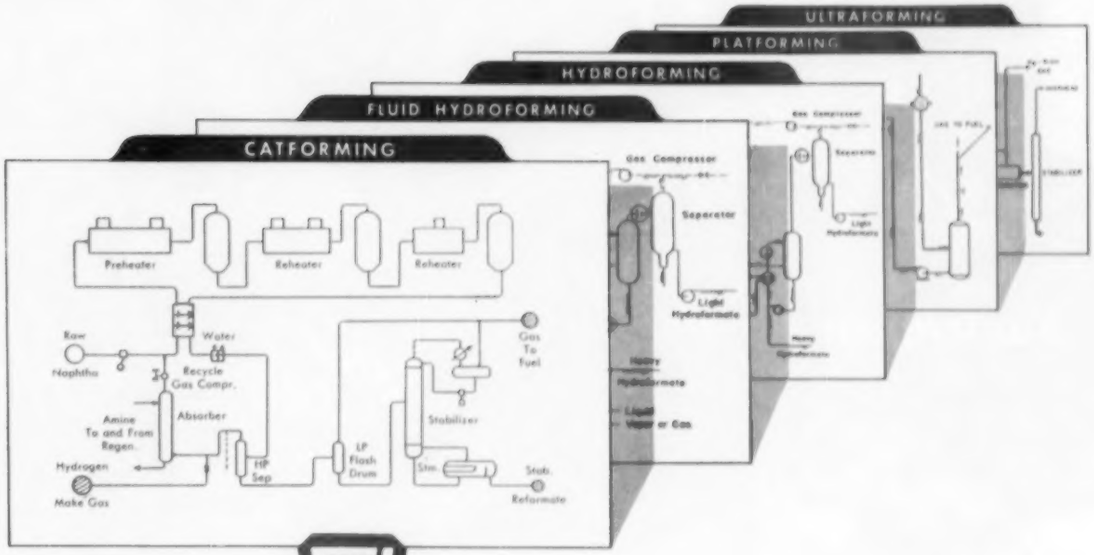
NOVEMBER

which method of

CATALYTIC REFORMING

is best suited to your needs

...FLUID or FIXED BED?



Here's why FW can give you the right answer

...and supply the complete job, too!

The success of catalytic reforming has led to the development of many different methods — both fluid and fixed bed. Selection of the most economical and efficient process for any given installation therefore poses an interesting problem.

Foster Wheeler has completed an extensive economic study of the relative values of the fluid method of catalytic reforming versus the various fixed bed methods. It was found that each has its merits . . . and its limitations. Proper selection depends on plant size, quality of charging stock, octane requirements and other factors.

Our wide design, engineering and construction experience in both fluid and fixed bed catalytic reforming is at your service. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

FOSTER WHEELER

Switchgear for Refineries

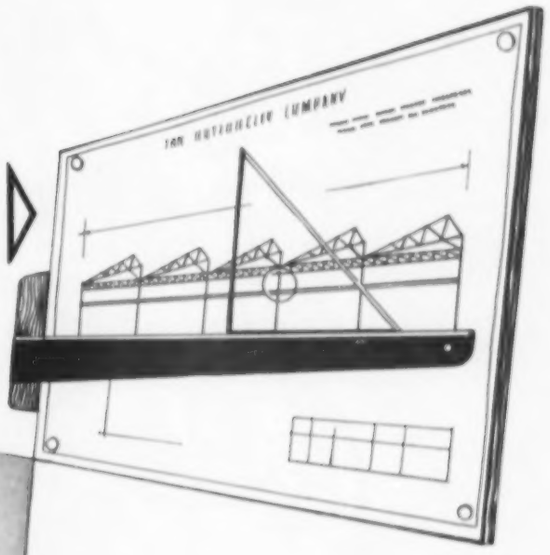
All of the high – voltage switchgear with its associated control- board for the Main Transforming Station of the Australasian Petroleum Refineries Ltd at KWINANA was supplied by Reyrolle, who also provided the distribution switchgear for the Area and Satellite Sub-stations.

The flameproof equipment, built to the special requirements of the Anglo-Iranian Oil Company Ltd for the local control of processes throughout the plant, is also of REYROLLE manufacture.

Reyrolle

A. REYROLLE & COMPANY LIMITED · HEBBURN · COUNTY DURHAM · ENGLAND

from drawing board



to erection on site

BUTTERLEY

Constructional Steelwork

The Butterley Company has been engaged in constructional steelwork from its early days and examples are to be found in all parts of the British Isles and in many countries overseas. From design, through the stages of fabrication to erection on site, every structure is invested with the skill and knowledge which have made the Butterley Company famous in the field of constructional steelwork. Welded methods are widely employed today and the shops are well-equipped to take the largest and heaviest work of this nature.

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CS-37

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Just as you expect an unlimited supply of water from your taps, so you can expect unlimited service from Kenyons as thermal insulation contractors for the oil industry. They operate anywhere in the world, will give technical advice, supply materials, labour and supervision. Let the Kenyon organisation undertake the whole of your heat insulation.

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PLANNED HEAT INSULATION

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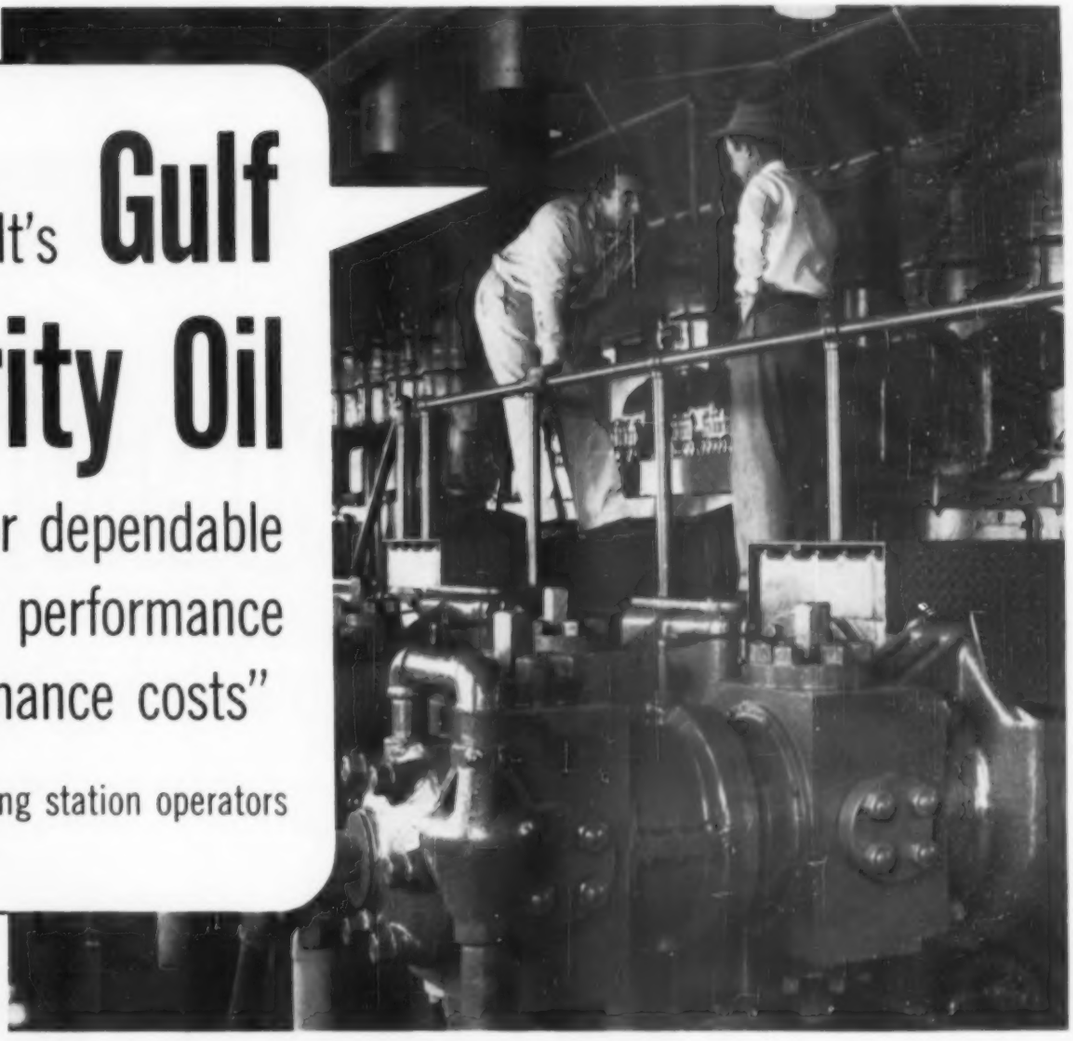
KW186

"It's Gulf Security Oil

for dependable gas compressor performance and low maintenance costs"

say pumping station operators



Smooth, continuous operation is a must for these units in service at a South Texas gas compressor plant. They are responsible for the steady flow of essential natural gas through pipe lines to homes and industries as far north as Detroit and New York. Gulf Security Oil provides the sure, effective protection needed for cylinders and bearings in both engines and compressors.

You can depend on Gulf Security Oil to provide the proper lubrication that is so important to vital compressor units if operating troubles are to be prevented and maintenance costs kept low.

Gulf Security Oil has a record of outstanding performance in scores of gas transmission plants. After years of operation with this quality oil, the cylinders and piston rings of both the compressors and power assemblies show negligible wear. And few carbon deposits have formed on power cylinder ports and pistons.

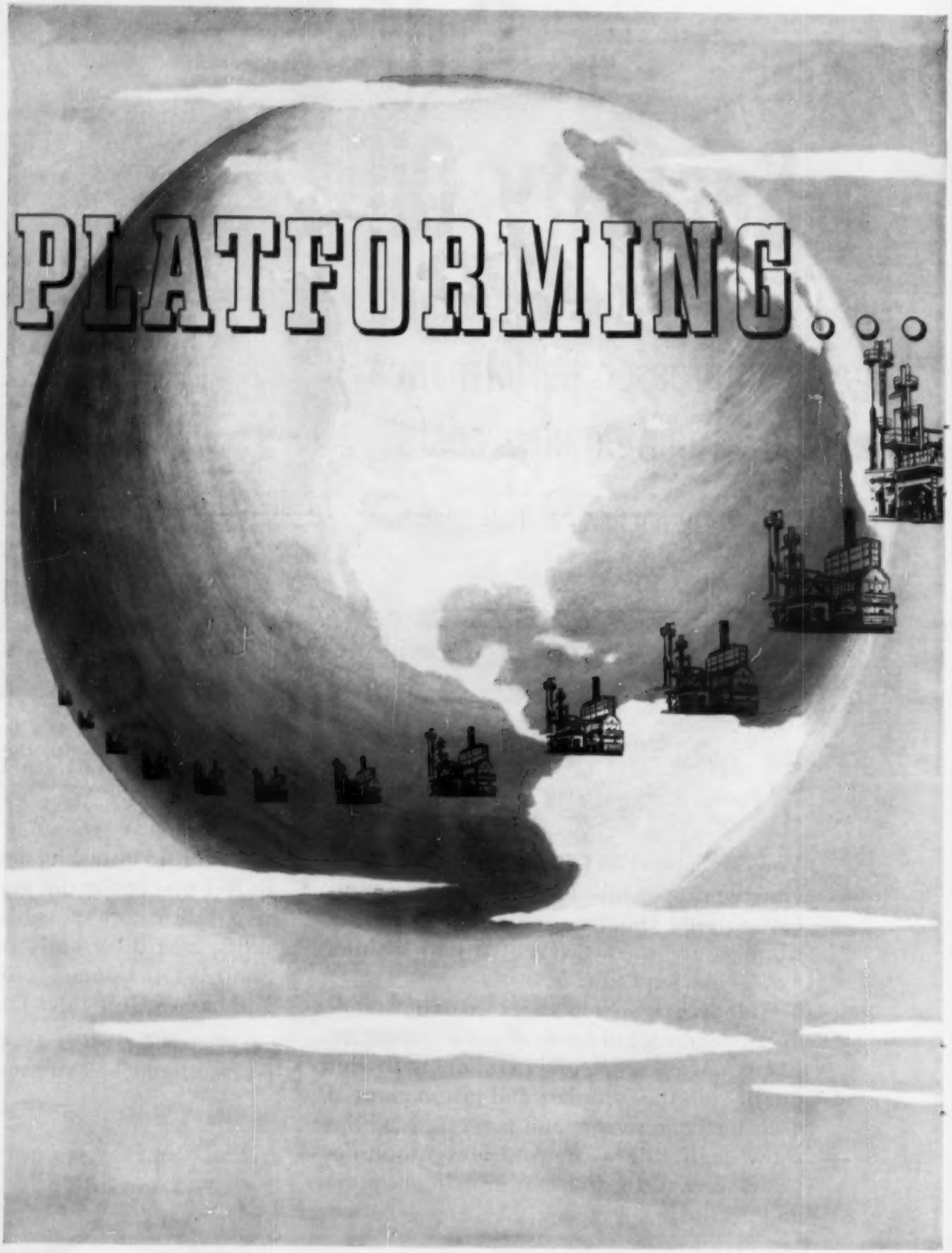
If you are installing new compressor units, or feel that you're not getting the most effective lubrication possible for your present units, it will certainly pay you to try Gulf Security Oil. Contact your nearest Gulf Office and have a Gulf Sales Engineer call.

Gulf Oil Corporation • Gulf Refining Company

1822 GULF BUILDING, PITTSBURGH 30, PENNSYLVANIA

GULF

The finest petroleum products for your every need


PLATFORMING...

Successful because it's so sound

No other modern petroleum refining process has had a growth parallel to UOP Platforming. Its record of industry acceptance is nothing short of astonishing.

Why did refiners accept Platforming so widely and with such assurance? The answer is simple—because they were confident that the process was the ideal method of reforming low octane stock into high quality motor fuels that would satisfy the most demanding markets.

Their confidence in Platforming and in UOP has been completely justified . . . their decision proved sound beyond any doubt. You have only to compare the record of all catalytic reforming processes . . . check the operating efficiency of units of practically any capacity . . . look objectively at catalyst life.

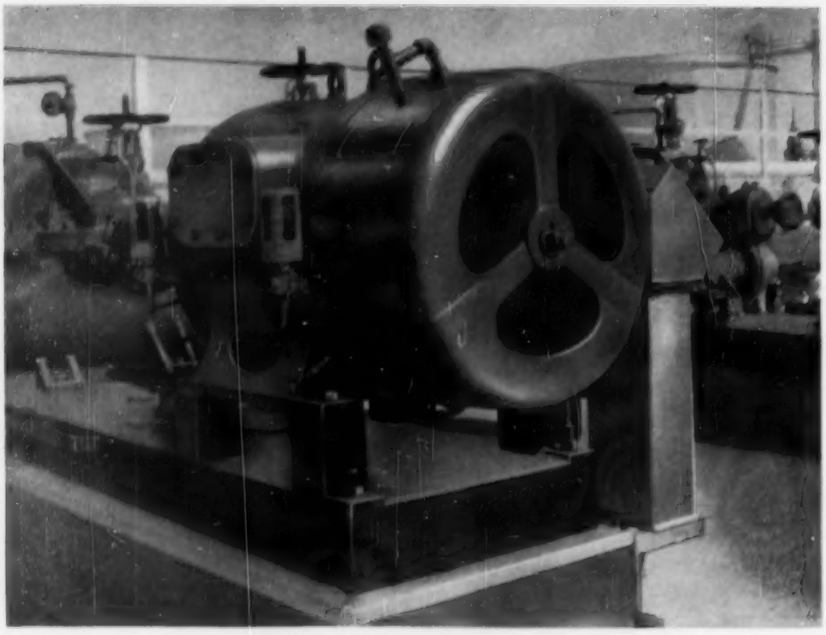
Careful examination of the UOP Platforming process will reveal immediate answers to your reforming problems . . . the answers that have prompted us to say—Successful because it's so sound!

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U. S. A.

Forty Years Of Leadership In Petroleum Refining Technology

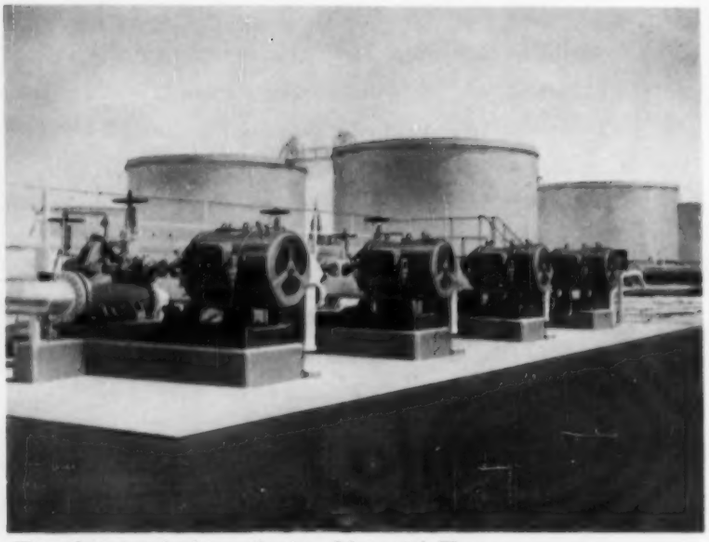
Flameproof Motors for the Oil Industry



A Metrovick 250 h. p. 1480 r. p. m. Flameproof Squirrel Cage Motor—one of four supplied to the Kwinana Oil Refinery.

Oil wells and refineries throughout the world rely on M-V equipment. Metrovick experience of motors and their proper application covers all drives in the oil industry, from drilling to refining. Some of the refineries using Metrovick motors are the Grangemouth Petroleum Refinery, Ltd., Shell Stanlow Refinery, Esso Refinery, Fawley, Trinidad Leaseholds Point-a-Pierre Refinery, B. W. I., and (illustrated) British Petroleum Company's Refinery at Kwinana, Australia.

Special arrangements were put in hand to guarantee that these motors were delivered to meet site requirements.



This photograph shows the four Metrovick Flameproof Motors driving kerosene pumps at Tank Farm Pumping Station No. 3. These motors are fitted with constant-level oil lubricators.

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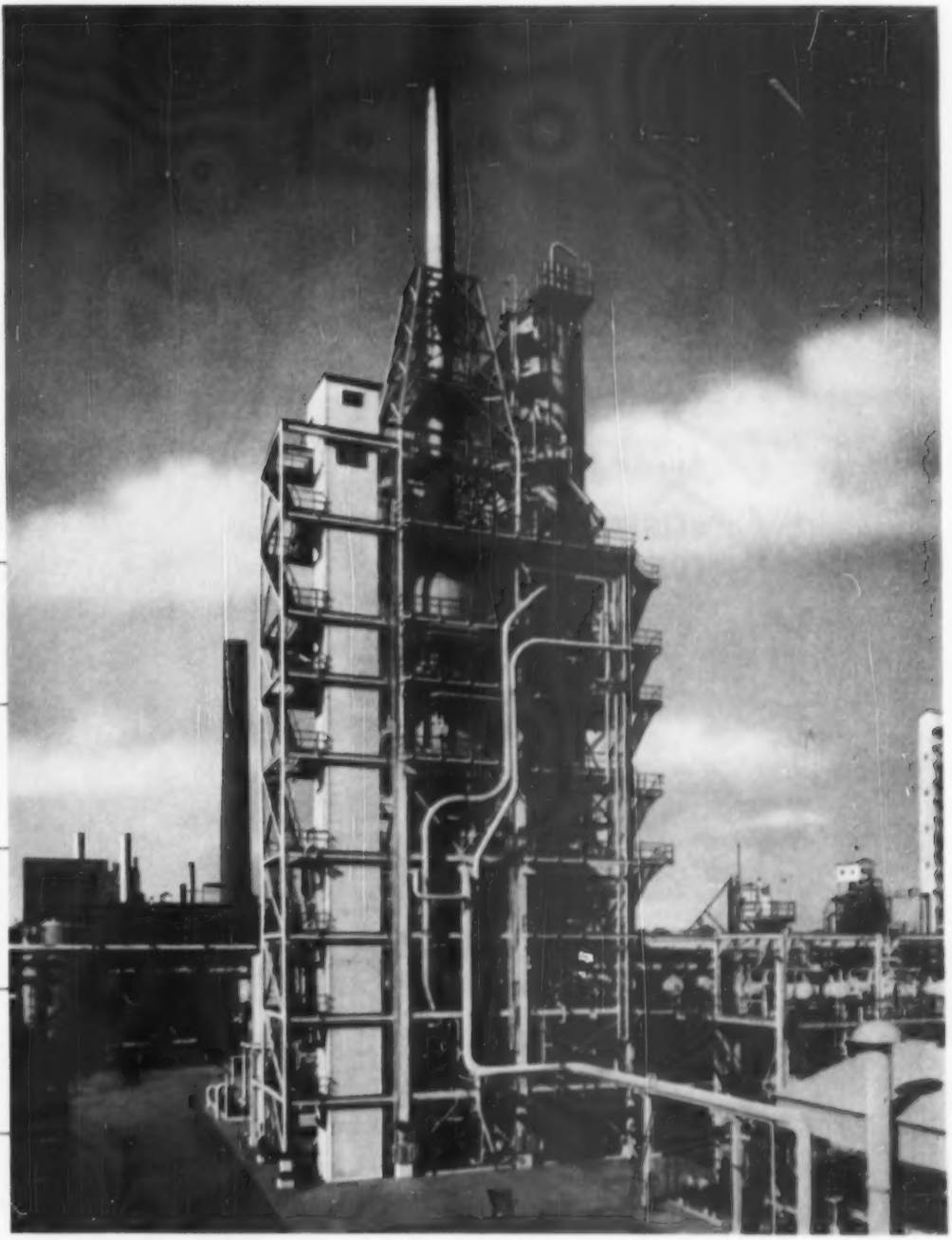
Largest Fluid Coker Completed at Baltimore



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On July 30, 1955, Lummus turned over to Canadian Petrofina, Ltd., the 16,000 BSD Houdriflow Catalytic Cracking Unit and the 3,000 BSD Hydrodesulfurization Unit built at their new Point Aux Trembles Refinery near Montreal.

Construction on these two units began late in April, 1954, with the client requesting that the plant be completed by September 1, 1955. Substantially ahead of schedule by March, 1955, Lummus and the client agreed to use an absolute minimum of overtime labor for the remainder of the project to allow simultaneous completion of other refinery facilities. Even so, the two units were completed ahead of schedule, at a cost below the original guaranteed maximum.

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16,000 BSD Houdriflow Catalytic Cracking Unit

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DESIGNING ENGINEERS AND CONSTRUCTORS FOR THE PETROLEUM AND CHEMICAL INDUSTRIES

VOL. 26, NO. 13 DECEMBER, 1955

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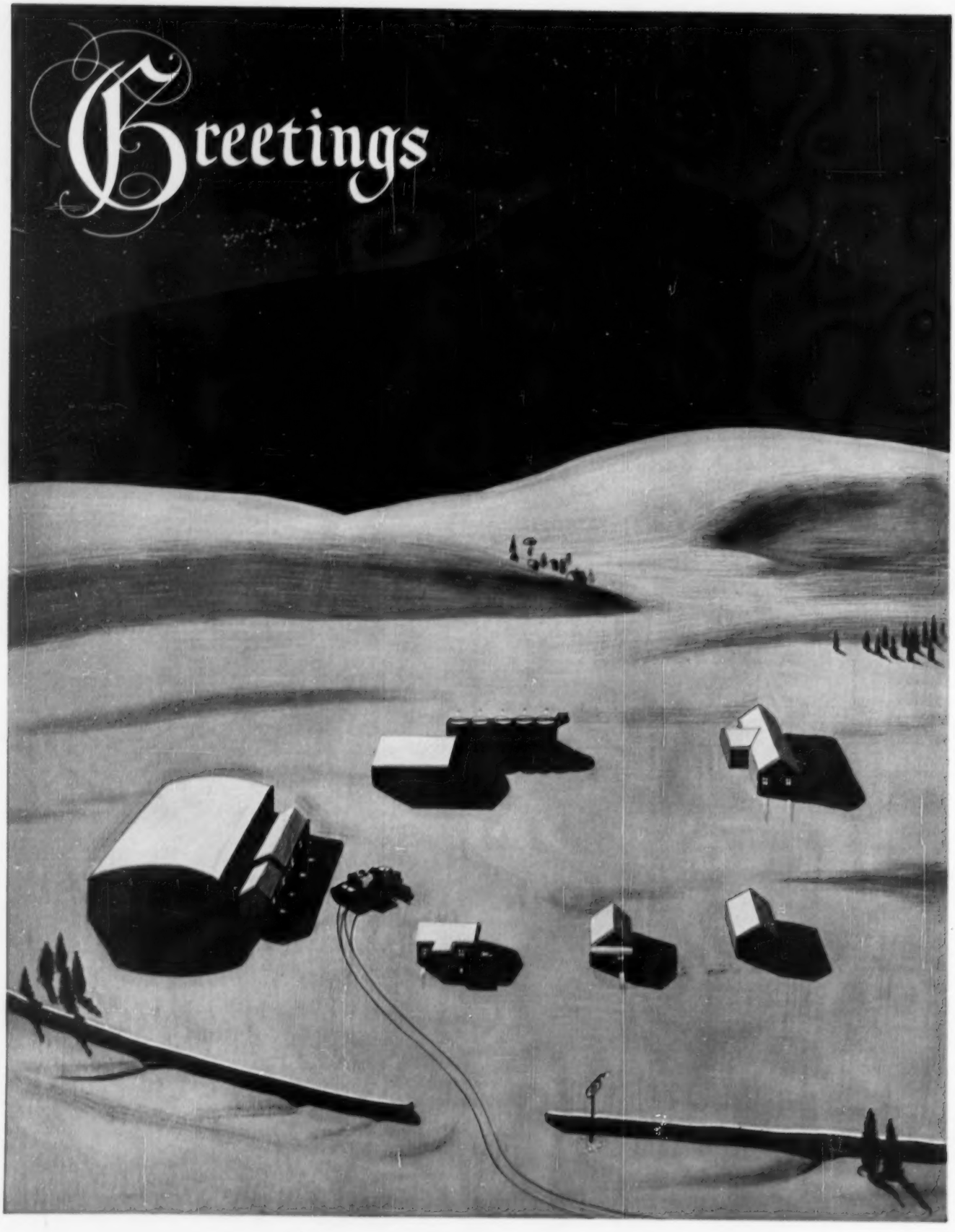
THIS MONTH'S COVER

Bergen Unit 11-18 drilled 60 miles west of Calgary, Alberta, by Shell Oil Co. and Oilwell Operators (Home Oil Company). Photograph of the pit mirroring the derrick was taken by C. W. Bryant for Shell Oil Co.



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New Aspect of Reserves and Imports

OUT of the increased attention directed to exploration for petroleum in areas that have long been subject to search have come some noteworthy results in the past few years. Industrial Europe, next to the United States the most important market for petroleum products, has shown itself a promising prospect for production. It proves a new revival for that venerable saying "oil is where you find it." In this case many of the countries which have given convincing evidence of their ability to provide impressive quantities of new supplies have been satisfied to rely on imports for 90 percent of their requirements.

Behind the change that has taken place, lies a shift in the balance of energy resources which many geologists have held to be a certain development of the future. The belief of these realistic scientists is that there are abundant deposits of petroleum remaining in Europe for example, but that the continent has been held in the firm grip of coal for the past century and more by the strong organization of that industry, its abundant supply of trained labor, and the favor in which it was held by governments because of the close dependence of armaments upon steel and coal.

The trend toward reliance upon liquid rather than solid fuel displayed itself directly after the close of World War II, but more convincing evidence is afforded by the accelerating drive to produce more dependable supplies from countries which in the past have been satisfied to rely on imports for 90 percent of their requirements.

Significantly enough, Germany, that is the German Federated Republic, has been the leader among the European nations in turning to underground supplies for increased power requirements. In two years, since 1953, it has increased the output of its central and western fields by 50 percent, from 42,000 to 62,000 barrels daily, and members of the industry are counting confidently upon the time when the bulk of their refinery throughout will be of domestic origin.

Facing Germany's Emsland field the two leading companies of The Netherlands are maintaining their small field which is producing about 20 percent of the nation's domestic requirements and at the same time are making a survey of coastal sands further west.

The Parentis discoveries in southwestern France and others made since that time have multiplied the small domestic production of that area by about threefold, but have had their most remarkable effect in stirring up a demand for exploration survey in practically every district in metropolitan France.

Since Austria recovered control of her oil bearing areas in midsummer of this year, plans have taken active form for leasing arrangements with private companies that are expected to add substantially to her crude production. Italy hopes to develop production to help in feeding her well established group of refineries as a result of discoveries in Sicily, in the Abruzzi region of the east central district and at the other points where exploration is being conducted by the national Italian company.

Across the Mediterranean in northern Africa where extensive surveys have been under way for several years, practical results of an encouraging nature have been reported from some of the newer exploration concessions including those in Egypt and most recently on holdings in Israel which are hailed as promising worthwhile production for that new nation.

These are but leaves from the new developments resulting from exploratory activities in these and other parts of the world in a period measured by months rather than years. Their importance lies less in the volume added to world production than in the fact that it gives national significance to the oil industry in a number of nations that have figured heretofore chiefly on wholly as purchasers of raw supplies and have had to cope with the economic problem thus presented. The addition of 40 percent to the probable output of petroleum in a few small countries of Europe and Africa does not materially alter the petroleum picture as a whole, but the fact that the industrial nations of Europe are definitely dissolving the bonds that in the past have bound them to the steadily shrinking number of adherents to solid fuel is of economic importance.

A decade of oil progress

By James W. Calvert

ON THURSDAY, Oct. 13, Continental Oil Co. announced that the CATC Group, of which it is the operating member, had brought in a discovery well to open a new oil field off the coast of Jefferson Parish, Louisiana, in the Gulf of Mexico.

The well is Louisiana Lease 953 No. A-1, Block 47, about 20 miles from Grand Isle, and initially produced 405 barrels of 38.7 gravity oil through a 10-64th inch choke in the first 24-hour test from the 13,614-20-foot level. It was indicated that the wildcat might have 82 feet of oil and 62 feet of gas sands in the Miocene section at five different intervals ranging from 9,845 to 15,054 feet.

This producer opened the 38th oil field in the offshore areas off the Louisiana and Texas coast, and brought to more than 850 the number of wells that have been drilled at sea since the end of World War II when the first frenzied prospecting for oil began in the Gulf of Mexico.

What is most significant about this latest discovery, however, is that it was drilled in 97 feet of water, the greatest depth yet undertaken at sea. It was drilled from a huge self-contained platform that cost the CATC Group (Continental Oil Co., Atlantic Refining Co., Tide Water Associated Oil Co., and Cities Service Oil Co.) $1,500,000 and required many weeks to construct.

It has proved that the oil industry can overcome almost overwhelming odds to develop new reserves in what may well become the greatest oil and gas fields in the history of the world. The story of how oil men are overcoming such obstacles as weather, sea, and tremendous prospecting costs to reach further into the Gulf, is almost fantastic.

While CATC was completing its wildcat in 97 feet of water, Shell Oil Co. was making plans to stake a location 60 miles southeast of Galveston, Texas, at the farthest point from shore yet to be undertaken. This well will be drilled on one of the Federal leases acquired by Shell for $5,423,760, and located in water from 80 to 100 feet deep.

The history of offshore drilling in the Gulf of Mexico actually dates back to 1939 when Pure Oil Co. completed three wells in shallow water off Cameron Parish, Louisiana, within one mile of land.

The war and the subsequent appearance of enemy submarines in the Gulf of Mexico put a stop to these operations, but the end of World War II just a decade ago found the oil men back at sea in whatever makeshift craft they could find, criss-crossing the vast expanses of water with seismic surveys and trying to figure out ways to build drilling rigs that would withstand the forces of nature.

Kerr-McGee made it in 1947 with the first well to be drilled out of sight of land. A few offshore wells were drilled in pioneering days until the Supreme Court shut off operations altogether with its tidelands decision of 1950, and then the surplus LST's and offshore drilling structures gathered rust for several years until, the Tidelands Act of 1952 reopened the way for drilling on the Gulf's vast continental shelf.

Operating results of the past year indicate that, insofar as the offshore areas are concerned, the industry is just now shifting into high gear. Out of a total of 840 wells drilled as of Aug. 1, approximately 340, or 40 percent, were completed in the 13-month period ending on that date.

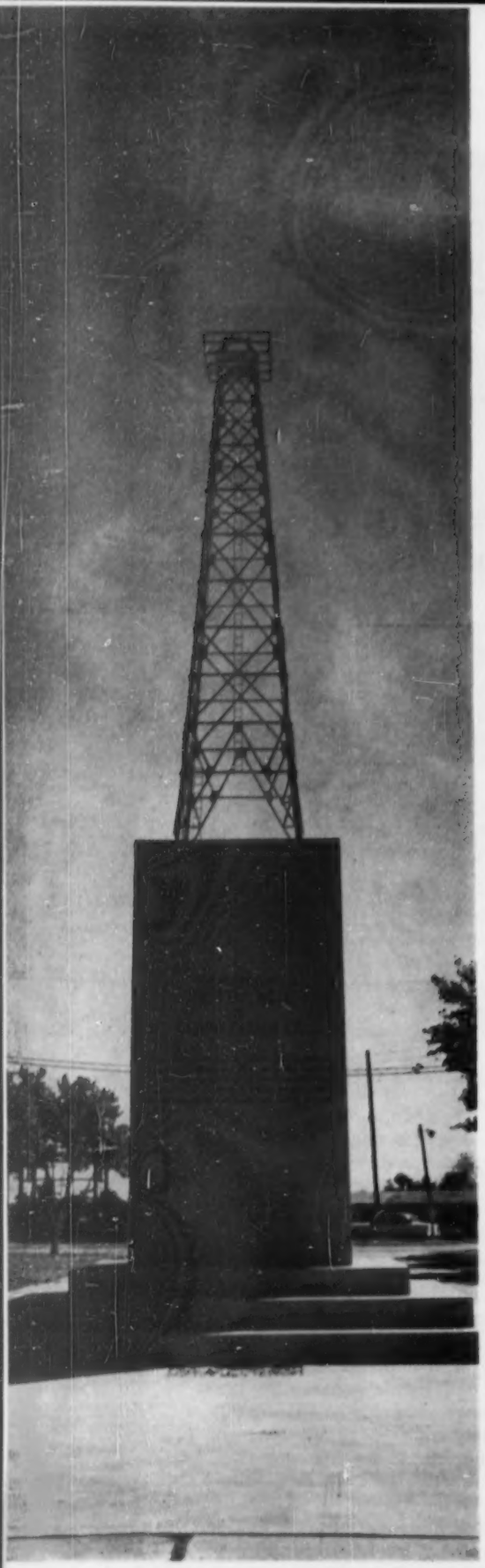
There were 186 oil wells completed in that period, or 41 percent of the total; 62 gas wells, or 51 percent of the total. Daily production of oil and condensate increased 17,000 barrels, or 27 percent of the total of 64,000 barrels, while the daily production of gas developed in the 13-month period amounted to 102 mmcf, or 43 percent of the total daily production of 241 mmcf.

There were 38 oil fields in the Gulf of Mexico by the middle of October, but some 49 percent of them had been developed during the preceding 15 months, and 55 percent of the 31 gas fields were discovered between July, 1954, and August, 1955.

The summary further shows a total of 68 producing structures on Aug. 1, of which 51 percent were developed during the preceding 13 months, while 34 percent of the 91 new structures were drilled during that period. A total of 2,798,000 acres of leases were acquired during the decade ending Aug. 1, of which 1,013,000 acres or 36 percent of the acreage acquisitions were made during the 13-month period ending on that date.

Seventy-three percent of the offshore wells drilled in that 13-month period were completed as producers, as compared with an average of 68 percent of all wells drilled offshore. At the present time the offshore production of oil and condensate represents about one percent of the national production.

Just when the industry may expect to realize a profit from the offshore operation, no one will hazard a guess. Exploration costs are increasing with the continuous upgrading of lease bonuses and exploration drilling costs. Lease bonus costs have mounted steadily since the first lease sale in 1945. The average price for acreage purchased up to July 1, 1954, was $42.20 per acre, while the average price recalculated to Aug. 1 of this year was $294.



Monument recently erected near Oil City, La. at the site of the first oilwell in Caddo Parish, La., completed March 25, 1905. The monument recites that the first offshore oilwell in the United States was completed in nearby Caddo Lake in May 1911 by Gulf Refining Co.

in the Gulf of Mexico

One can readily judge how this increase has taken place by comparing the various acreage sales of the Federal government. The first Federal sale of lands off the Louisiana coast averaged $310 per acre. The second sale of Federal owned lands, off the Texas coast, brought $344 per acre as an average, while the last sale of the Department of Interior, for underwater tracts off Louisiana brought an average of $395.92 per acre plus the highest bonus offer ever submitted to the Federal government, $1,505.40 on a 5,000 acre tract.

From the standpoint of production, oil men forsee a lowering of per barrel costs through the building of proper rigs and the development of more adequate tools. C. G. Glasscock of Corpus Christi, for example, believes it may not be too long before the offshore operations are economically feasible.

"It is still too early to really tell whether we are going over our heads," said Mr. Glasscock, one of the few independent oil men to venture into the offshore areas. "We still do not know for sure what it will cost per barrel to put the oil into the refinery. That is the real measure of a successful oil operation. Today the cost per barrel for producing oil and gas in the offshore areas is almost prohibitive. It is necessary that we whittle down the lifting cost."

Another offshore pioneer feels that large scale activities will bring about a reduction in operating costs. George B. Parks, Oklahoma City, drilling superintendent for his company in Morgan City when offshore operations began. Speaking before the 33rd annual meeting of the Louisiana-Arkansas Division of the Mid-Continent Oil and Gas Association recently, he declared that development drilling costs are sensitive to large scale operation or concentration of activity in an area.

"One major producer and developer of offshore crude advises that their development drilling costs will probably reflect a reduction for the last year's operation," he said. "Part of this cost reduction is due to improved operating practice acquired from offshore experience, as well as general operating practice improvements in the industry.

"Unit costs for oil and gas production are so affected by volume that operators having production increases in an area find lower unit costs, while those losing volume of production through allowable reduction, or for other reasons, would generally have an increased cost regardless of the recent increase in labor, material, and services chargeable to producing costs.

"The reduction that can be made in producing and transportation costs through large scale activity offshore is pointed out by the recent completion of a 50-mile 12-inch pipe line and an elaborate gathering system by one group of operations in the Ship Shoal area. A rate of offshore activity that will allow development of reserves and daily production to give a reasonable rate of return on this investment from lowered producing and transportation costs will materially reduce the cost of offshore operation."

Mr. Parks pointed out that the No. 1 factor in the economics of offshore drilling is the availability of equipment.

"On the coastal land belt, operators have spread exploration and the development over more than half a century," he declared. "The companies that were successful in the early years have been able to use the income from their discoveries to finance new exploration. In the offshore area, because of mineral interest, the high finding power of present day exploration methods, and the presence of a large number of first class salt domes, prospector operators are having to make their investment in leases and exploratory drilling in a relatively short time. This tremendous investment in leaseholds, along with the fact that production costs are usually far in excess of land costs until daily production in a field reaches a volume of 1,500 to 4,000 barrels per day, places a premium on equipment for quick evaluation and development of leases and the return of investment."

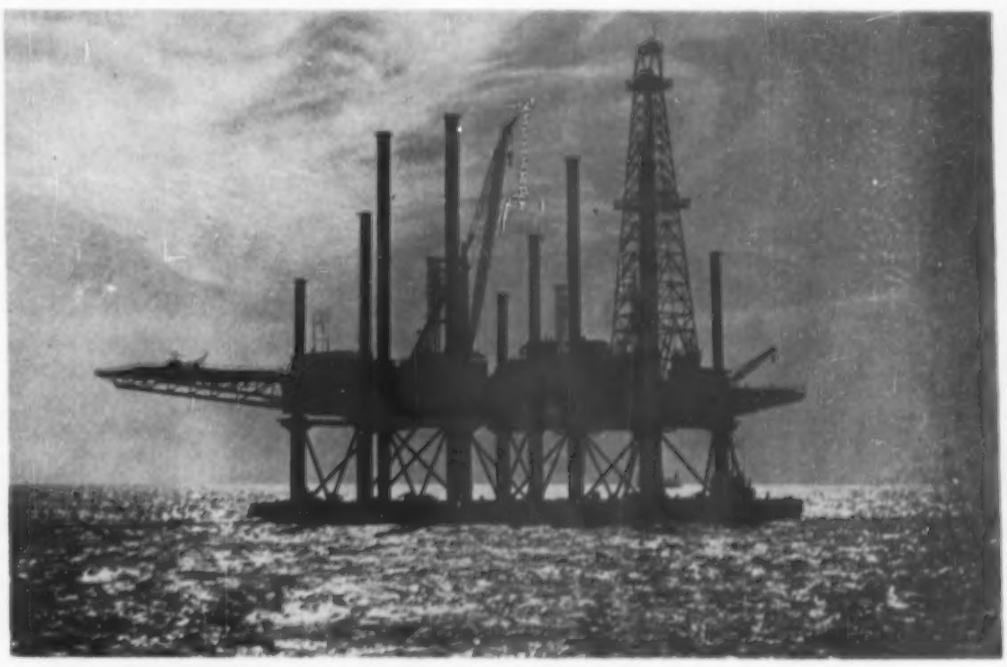
It seems to be a concensus of many operators, as well as shipbuilders, contractors and other suppliers of the industry, that this frenzied search for oil in the coastal regions of the Gulf of Mexico will continue for some 10 to 15 years. At least the various industries appear to be gearing themselves for such a period.

As one operator pointed out, the high rate of deterioration of equipment in salt water and salt air makes it necessary to work fast. The number of drilling rigs and equipment units available for offshore work has increased proportionately to the increase in activity, but apparently it falls short of meeting the present demand.

Every shipyard on the Gulf Coast is jammed up with work orders while engineers and architects are working overtime on designs for rigs that will operate in 200 feet of water or deeper.

Today there are some 59 units available or nearing completion stage, as compared with a total of 39 available and five under construction on Sept. 1, 1954. Fourteen of

"Mr. Gus," deep water submersible barge of the G. C. Glasscock Co., being towed to an offshore location. "Mr. Gus" withstood hurricane force winds for 40 hours early last fall as hurricane "Gladys" raked the Mexican coast.



the 59 units now in operation are mobile rigs of varying sizes and designs; 34 are tenders for servicing small permanent drilling platforms; 11 are self-contained platforms, containing living quarters for the drilling crews, storage facilities and pump and power units in addition to the drilling equipment.

The mobile rigs, most of them submersible barges, are also self-contained units while the tenders, some of them converted war-time LST's and others newly designed and constructed non-propelled vessels, serve as hotels, warehouses and powerhouses for the small drilling platforms. In addition to these units in or near operation, there are some 11 mobile rigs that are just beginning construction or are substantially ready to begin.

In his survey of offshore operating conditions, Mr. Parks summarized the offshore acreage by water depth brackets in relation to available drilling equipment.

Twenty-seven percent of the offshore acreage off the Texas and Louisiana coasts is in the bracket from zero to 20 feet in depth; 23 percent is in the 20-40-foot bracket; 28 percent in the 40-60 depth range; 12 percent of the acreage is under 60 to 80 feet of water; six percent from 80 to 100 feet, and four percent from 100 to 120 feet. No acreage has yet been leased beyond the 20 fathom line. (The continental shelf extends seaward to 100 fathoms or 600 feet).

Mr. Parks found that all existing offshore drilling units can work in the 0-20-foot depth bracket, although some of the units are not economically competitive. All but two of the present mobile units can be used throughout the 20-40 foot bracket. All drilling tender units and self-contained fixed platforms will work in the 40-60-foot bracket, and some of the mobile units will meet that requirement.

The submersible rig is the answer for wildcatting. Most of the rigs now in operation can be quickly submerged or refloated and moved to a new location. Of all the wells drilled by mobile units within the past year, there has been only one serious mishap; that was when the American Tidelands submersible drilling barge capsized while she was being raised to shift to another drilling location. She was raised, refloated and towed to Alexander Shipyard in New Orleans where she was overhauled, repainted and returned in October to fulfill her drilling contract with Humble Oil & Refining Co.

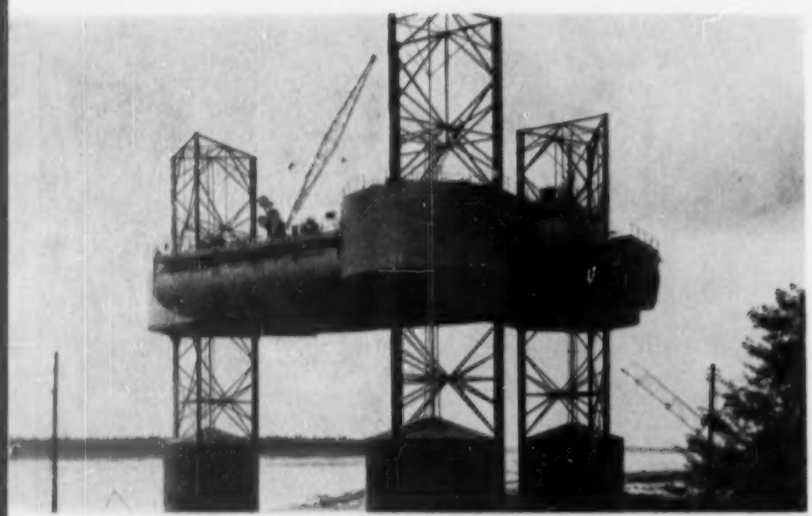
It costs approximately $750,000 to erect a permanent fixed drilling platform, even a small one, at sea. The large self-contained platform, such as the CATC structure will cost an estimated $1,500,000 or more. Since it costs approximately $420,000 to drill a 13,000 foot well at sea, it is therefore possible to drill from a submersible rig at little more than half the cost of constructing the drilling platform.

Of course, the permanent platform does have an advantage in proven territory because multiple wells can be drilled from the same structure and the platform provides a permanent facility for servicing the flowing wells; but even the newer mobile units are being designed for multiple well drilling. California Company's new submersible rig, now under construction at Avondale Marine Ways, New Orleans, will have a derrick from which four directional holes may be drilled, while the newly formed Coral Drilling Co. is having a unit built by Alabama Drydock Co., Mobile, with a three-position derrick. Both units will have a capacity for drilling in water up to 75 feet deep. Both were designed by Friede & Goldman, marine architects, of New Orleans.

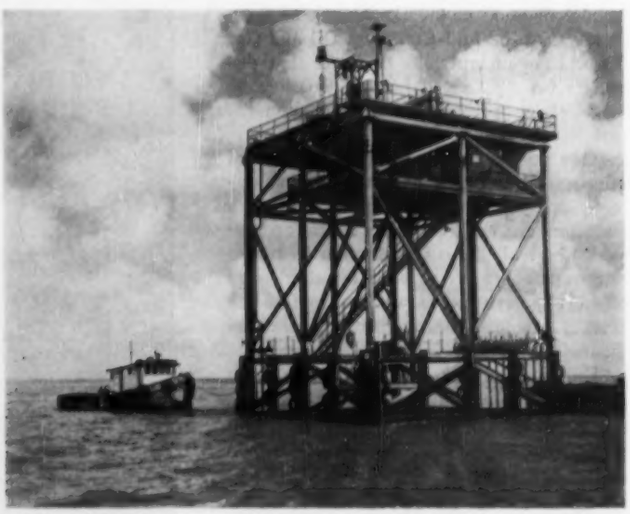
The apprehension voiced by many oilmen one year ago as to the ability of the mobile units to withstand the sudden and violent tropical storms of the Gulf has long since been dispelled. With a summer and autumn of unusually severe hurricanes and other tropical storms, the mobile units came through with a minimum of idle time and practically no serious damage.

The C. G. Glasscock rig "Mr. Gus," completed last year by Bethlehem Steel Co. at Beaumont, is a good case in point. "Mr. Gus" was drilling about 13 miles off Port Aransas, Texas, in 80 feet of water, when hurricane "Gladys" moved viciously toward the coast of Mexico in early September, accompanied by two other unidentified storms. Weather forecasters indicated that "Gladys" would turn southward toward Tampico, and so she did; but there was no reference in any of the weather reports to her two little pals. Indeed they searched out, and clung around "Mr. Gus" like the hub of a wheel. For more than 40 hours "Mr. Gus" withstood winds of over 80 miles per hour and battering 22-foot seas. The crew of 30 men remained aboard throughout the storm. Most of the other rigs operating in the Gulf went through similar conditions.

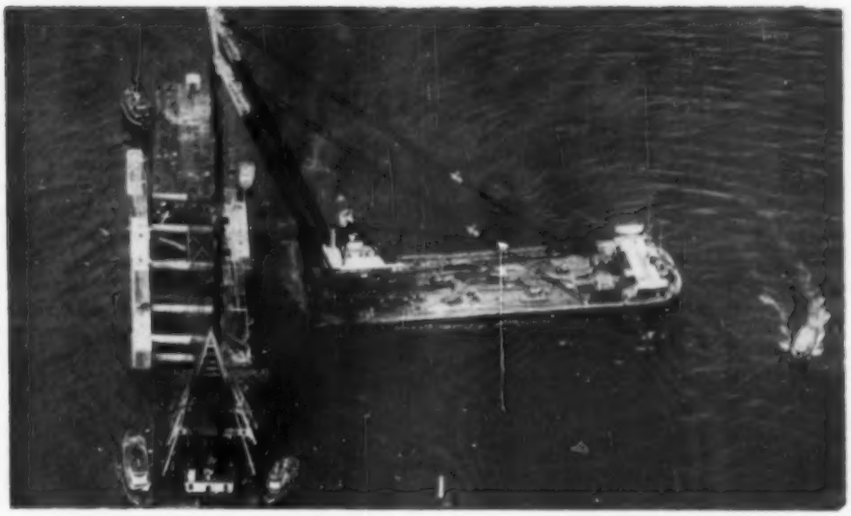
The demand for larger and more modern drilling equipment has given new life to the shipbuilding industry along the Gulf Coast. Only the shipyards have facilities for fab-



Nearing completion at the R. G. LeTourneau plant near Vicksburg, Miss. is the newest and most unconventional design for an offshore drilling rig. This tri-legged platform will be operated by Zapata Offshore Drilling Co. This giant, which dwarfs the automobile shown at its base, has 140-foot legs.



Of all the giant drilling platforms to go into service since offshore drilling began, only a few have been involved in serious accidents. One was American Tideland's submersible barge "101," which capsized in 35 feet of water last June while being refloated preparatory to moving to a new location.



Another shell design is this unique production platform in South Pass, block 27, field, which is a sort of "switchboard" central gathering point for 30 offshore wells. High pressure pipelines connect the wells in the field to the platform. The structure has three decks, stands more than 50 feet above water.

ricating such tremendous masses of steel. Major yards, such as Higgins, Inc., Alexander Shipyard, Avondale Marine Ways, Calmes Engineering Co. and Equitable Equipment Co. in New Orleans; Ingalls in Pascagoula, Miss. and Alabama Drydock in Mobile; Levingston and Consolidated in Orange, Texas, and Bethlehem in Beaumont, are working around the clock.

Hunt Teel, general manager of Alabama Drydock, declared the Gulf Coast yards are making more money than any time in their history, even including the war years. The major orders are coming so thick and fast that the big shipyards are turning down small jobs, for which they were begging a few months ago. Consequently, smaller shipyards such as Bryant Boats, Inc., in Bayou LaBatre, Ala., Sewart Seacraft in Morgan City, and Burton in Port Arthur are specializing in various types of small craft and are reaping a rich harvest.

But it is the behemoths of this present-day Spindletop, the giant mobile drilling units, that provide the real glamor.

At this writing there are three under construction at Avondale alone, all designed by Friede & Goldman. Two of the structures are similar to California Company's first mobile unit, the S44, designed to operate in water depths up to 40 feet. One is for The California Co., the other for Southeastern Drilling Co.

The big job at Avondale, however, is The California's Company's $2,500,000 structure which will be able to operate in water depths up to 75 feet. The barge is 190 feet in length with a beam of 150 feet, including anti-scouring wedges, and the hull depth is 12 feet. The clearance from the hull to the underside of the elevated drilling deck is 90 feet. The vessel has a displacement of 4,532 tons.

Port and starboard wedges are secured to the hull and extend the length of the vessel. They are there to provide stability under tow and to give additional protection against bottom scouring. The lower edge of the wedges have a four foot lip which penetrates into the mud. On the forward end of the hull is a movable hinged section which serves as a rake while under tow. When lowered it provides additional protection against scouring.

The hull, port and starboard wedges are compartmented into tanks for ballast, drinking water, fuel oil and also provides the pump room. Pumps are operated by remote control.

The elevated deck is supported by 10 columns, eight of which are utilized for the hydraulic system which raises and lowers the pontoons. These columns are 42 inches in diameter. The remaining columns, of 60-inch diameter, are utilized for access from the deck to the barge pump room. One of these columns has an elevator.

The platform has three decks, providing air conditioned quarters for a crew of 80, with necessary storage space for cement, mud, pipe and other drilling material. All machinery and pumps are electric driven, powered by two diesel generator sets.

To prevent corrosion in the "splash zone," that area which comes in contact with both sea and air, some 40 feet of the columns are wrapped in stainless steel with cathodic protection for the hull.

However, even this giant would be dwarfed by Friede & Goldman's design for a mobile unit which could drill in water from 80 to 120 feet. This unit would have two hulls, the lower hull nesting in the upper hull when the platform is afloat. On location the lower hull would be depressed to the bottom, exerting pressures of approximately 255 pounds per square foot. The lower hull, which will be five feet deep, has a lower lip projecting beyond the mud line to minimize bottom scouring.

With the lower hull submerged, the upper hull would be raised to the desired level for drilling. This raising and lowering of the hulls would be achieved by hydraulic means, using sea water as the hydraulic field. Hydraulic jacks would provide a positive grip on the columns, thus eliminating the use of clamps which tend to gauge and weaken the steel columns. These jacks would have a 40-foot stroke, reducing the time required to pass through the dangerous area where the lower hull comes in contact with the ground, and the upper hull is first raised out of the water. To reduce the tipping moment of the barge, the columns would be tapered from top to bottom.

The upper hull would be 200 feet long, 33 feet wide and 14 feet deep and will have a 32 by 33 foot drilling slot. The lower hull would be 130 feet long and five feet deep.

Storage facilities would provide for 14,000 feet of drill stem, 300 feet of surface casing, 1,000 sacks of cement, 2,000 barrels of dry mud, 200 barrels of fresh water and 1,000 barrels of fuel oil. There will be air conditioned quarters for 40 men.

Every Gulf marine architect worth his salt has a deep water drilling unit at least on the drawing boards. Higgins, Inc. has developed a submersible unit capable of operating in a wide range of water depths and which has the advantage the designers contend of a simplified construction which tends to keep initial costs at a minimum and reduce maintenance costs over a long range period.

The Higgins unit consists of four major components, two side barges, one center barge and a drilling platform. The platform is carried by the center barge, which is attached to the side barges through a series of guides. Upon arrival at the drilling site, the side barges would be lowered independently and the platform locked to the columns of the side barges by means of a mechanical device. The center barge would then be submerged.

The drilling platform would be 160 feet long and 67 feet wide and would be completely self-contained. The center barge would be 150 feet long and sufficient in size to support the drilling platform while under tow. The side barges would be 180 feet in length and would support eight columns 24 inches in diameter and 120 feet high.

Each of the units would have sufficient stability to be towed independently in sheltered waters. Once beyond restricted areas the three units would be assembled by bringing the side barges alongside the center barge and securing them with guides provided for the purpose. After this is accomplished the derrick could be built, all bulk materials loaded and additional drilling equipment installed.

The designers contend that use of the three barges would provide a suitable spread footing to offer resistance to overturning from external forces, and would permit variation of bottom pressure to offset soil limitations in certain areas.

These two types have been proudly and freely publicized by their designers, but in almost cloak-and-dagger secrecy two major companies are working on designs which are rumored to be quite revolutionary. Kerr-McGee Oil Industries, Inc. has a staff of engineers and designers working with shipyard personnel at Ingalls Shipbuilding Corp., and Shell Oil Co. has quietly asked for bids on a design of its own.

Of all the drilling structures that have been built or are nearing completion stage, the greatest departure from what might loosely be classified as "conventional" is the LeTourneau tripod drilling platform built at Vicksburg, Miss. by R. G. LeTourneau, Inc. for Zapata Off-Shore Co.

The LeTourneau drilling platform, previously described in detail in World Petroleum (November, 1954), is scheduled to be in operation by year's end. Basically, the platform is a large shallow-draft barge equipped with three electro-mechanically controlled spuds designed to operate in water up to 80 feet deep. On location the spuds, or legs, would be lowered to the ocean bottom and the self-contained drilling platform elevated to the desired height. Principal advantage of the LeTourneau design is the tripod which gives the platform a level three-point support similar to that of a three-legged table. This provides equal bearing on each leg at all times. The spuds may be raised or lowered individually so as to provide trimming on an uneven ocean floor.

One of the greatest problems of offshore operators is that of transporting men and materials to the drilling locations. They are utilizing a wide variety of craft for this purpose, ranging from fast ocean-going "speed boats" to the work-horses of the offshore oil fields, the slogging supply boats equipped to carry pipe, mud, cement, drilling water and groceries in a single trip.

The war surplus landing craft, which carried the brunt of the offshore work in the early days of the exploration, are wearing out and are being replaced as rapidly as possible with modern, diesel propelled vessels which are called upon to perform a multitude of duties, from towing barges to transporting sight-seeing executives.

When operations were confined largely to relatively shallow and protected waters the standard vessel for transporting drilling crews was the 38- to 55-foot speed boat, powered with high speed twin diesels and fitted out like a bus with seats athwartship to carry from 30 to 40 men.

A vessel of this type will cost in the neighborhood of $1200 per seat. As oil men invade deeper water, greater distances from shore, it has been necessary to utilize large and slower vessels.

One shipyard representative called on the major companies operating in the Gulf to learn what they expected or wanted. "I found their ideas were pretty unreasonable," he related later. "The majority wanted boats 65 to 80 feet in length, capable of 25 mph speeds, that would cost no more than $50,000 to build and would rent for more than $100 per day."

David Levy, chief engineer for the New Orleans plant of Equitable Equipment Co. has reached what he believes to be a compromise in a sea-going crew boat with his 51-foot hull, powered with twin GM 610 model diesel engines, having a cruising speed of 20 miles per hour. This vessel is certified to carry 32 passengers and a crew of two to four men. A crew boat of this type costs $53,000 and charters for $155 to $185 per day, with crew, depending upon the job and the circumstances.

Use of the helicopter in transporting working crews to and from the offshore rigs has replaced surface vessels to some extent, but the "whirly-birds" have obvious limitations and because of them the crew boats will never be eliminated, the safety engineers declare. However, "heliports" have become standard equipment for all offshore self-contained rigs, submersible units and drilling tenders.

Safety-conscious marine superintendents of the operating companies, most of whom are former shipmasters, are ever aware of the dangers that constantly surround an offshore marine operation and the most adamant in this regard is Capt. E. R. Vorenkamp, of New Orleans, marine superintendent for Shell Oil Co.

Speaking recently at a meeting of the Southern Safety Conference, Captain Vorenkamp pointed out that the transfer of personnel and cargo at sea in exposed waters is of greatest concern to the operators.

"The problem of transferring personnel from a small to a larger vessel is as old as men have 'been going to sea,'" he said. "Sailors have been struggling with this problem for centuries. It is ridiculous to think we can solve it in a few minutes. Actually, the transfer of men and material from a small boat to a fixed structure in unprotected waters is a great deal more difficult and hazardous than a similar transfer from a small boat to a large vessel. In the latter case the ship can 'make a lee' for the small boat, and both vessels are affected by the same motion of the sea."

The proper method of landing a small vessel is to head into the sea, a condition that is frequently impossible in going alongside a fixed drilling structure or submerged rig. It is particularly difficult and dangerous to handle cargoes of pipe. If even a moderate sea is running the pipe will roll as soon as the lashings are released. A possible answer to that particular problem is to load pipe in bundles of three to prevent rolling. Some companies have utilized this method successfully and it may become standard procedure.

Shell is experimenting with an idea of a large sea buoy secured some distance from the rig by means of four heavy anchors. This would permit cargo and personnel vessels to moor head to the sea at all times and unload cargo which would be subsequently transferred to the drilling rig by means of a "high line."

Even personnel could be transported in this manner, Captain Vorenkamp believes, with a greater degree of safety than by unloading directly alongside the structure. Liquid cargoes, such as water and fuel, would be transferred by hose from the buoy, along the floor of the ocean to the drilling tender or platform. The buoy is now "on the drawing boards" in the engineering department of Shell Oil Co. in New Orleans.

Another most perplexing problem that has developed with the opening of the offshore oil fields has to do with insurance matters. For example, take the roughneck who does his eight-hour tour on an offshore drilling platform and then retires to the comparative luxury of his air conditioned quarters. Is he an oil field worker and, as such, protected by the statutory law of the state in which he is hired? Is he a longshoreman by virtue of the fact that he works on a fixed structure at sea and thus should come under the Federal Longshoremen's and Harbor Workers Compensation Act? Is he a seaman and, therefore, protected under the Jones Act? To this date the workmen's compensation and employers' liability insurers cannot accurately classify employes in connection with these operations.

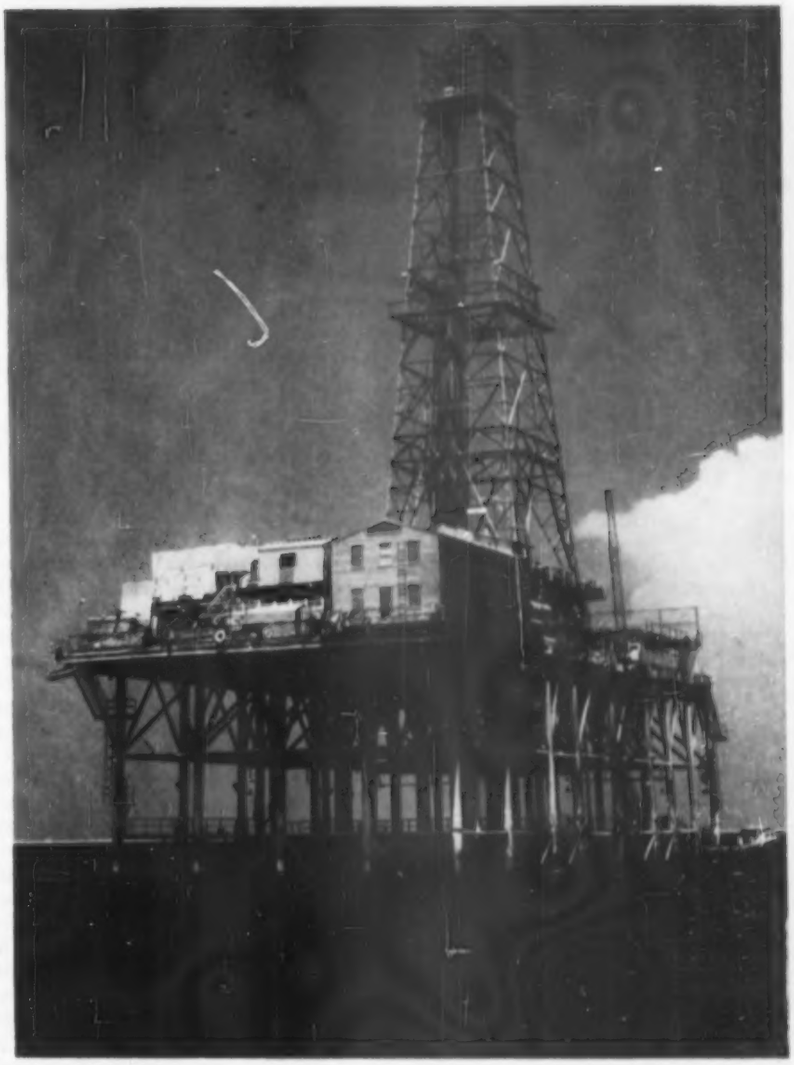
According to John B. Mead, head of Marsh & McLennan's New Orleans office, there seems to be no definite amount of law that will allow an underwriter to properly judge the classification of an offshore oil worker.

Mr. Mead is one of the best informed men in the world on insurance matters pertaining to this phase of the oil business. He began his studies of the problem when the

OFFSHORE PRODUCTION
As of Aug. 1, 1955

	Number of Wells	Daily Production	Total Production
Louisiana	430	65,616	59,580,476
Texas			
Federal			

(Louisiana data from Miss B. Breyou, Esso Standard Oil Co.)



The first permanent self-contained platform built by Shell Oil Co. off the Louisiana coast is this structure, now sinking a wildcat well in 72 feet of water in East Bay, Block 42, near the mouth of the Mississippi River. The 460 feet long piling upon which the structure is built penetrates 200 feet into the ocean floor. Twelve directional wells can be drilled from this platform which was erected at a cost of $1,250,000. Avondale Marine Ways, Inc., fabricated the structure. It was built in six sections and assembled by J. Ray McDermott & Co. on the Gulf location in 26 days.

first oil prospectors went into the Gulf of Mexico and he has been working at it ever since. To answer the question posed by the classification of the oil field worker, Mr. Mead explained that there is a standard form of insurance in connection with compensation and employers' liability called Voluntary Compensation.

"Under this form a company agrees to give a claimant the benefits under the statutory laws of the state of hire, regardless of his classification, provided he will accept these benefits," Mr. Mead explained. "Incidentally, he usually does. Even though this answer is not entirely satisfactory, nevertheless it provides the underwriters with a solution to the problem of coverage relating to the liability of the employer to his employes in this particular field."

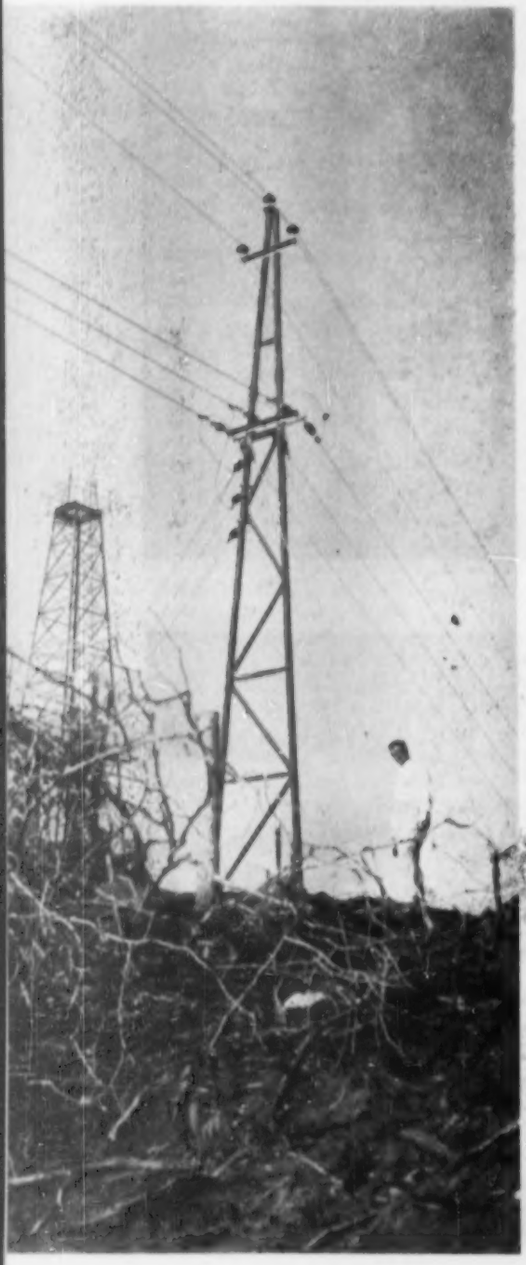
Mr. Mead said that general liability insurance presented an entirely different picture. "Normally, liability protection to the land operator is provided under a comprehensive general liability policy," he said. "However, this was not designed to include a marine operator and certain exclusions in this coverage related to the operation of watercraft. It is, in many cases, almost impossible to determine whether or not some of the units used in connection with offshore oil operations are pure vessels. For example, the submersible drilling barge, although equipped to support itself while navigating to and from locations, is nevertheless destined to submerge at specific locations and, in its submerged position, become more or less a fixed type platform for drilling.

"Fundamentally, the question is whether or not this is a vessel simply because it has in its composition a section which will support the unit while afloat. Some feel this is merely a convenience of transportation. Others feel it is indeed a vessel since it can navigate, although admittedly not under its own power. I believe it is currently the opinion among underwriters and brokers that such units should be insured under comprehensive general liability, whereas the pure vessels, such as barges, tugs, supply vessels and other types of craft, are subjects of protection and indemnity insurance."

(*Continued on page* 74)

First submersible rig to drill in more than 30 feet of water was this barge of Ocean Drilling and Exploration Co., a real veteran of the offshore oilfields.

THIRTY YEARS OF OIL FIELD



Typical A-frame pole made from scrap pipe and channel or angle iron. The 13,200-volt circuit is at the top of the pole. The lower circuit is the 480-volt service to the oil wells.

By Everett E. Thomas

Concesion de mares is located on the east shore of Rio Carare and Rio Magdalena to Rio Sogamoso which is the northern boundary of this concession of 512,000 hectares or 1,263,500 acres in area. An oil refinery is located at Barranca Bermeja which is the river port on Rio Magdalena for the concession. Barranca Bermeja is about 400 miles by boat or 300 miles by airplane south-southeast of the seaport of Barranquilla; also, about 90 miles north of Bogota by airplane. The main oil field camp is known as El Centro located about 12½ miles southeast of Barranca Bermeja or 17½ miles along the road.

Rio Colorado flows along the southern end of the developed oil field area and empties into Rio Magdalena. A long and prominent oil seep at the Infantas fault on the north side of this river was found about 40 years ago and the oil concession was obtained by Benedum & Trees of Pittsburgh, Pennsylvania, U.S.A., during the year of 1916. They organized the Tropical Oil Co. to develop this area. After drilling a few wildcat wells, they sold their concession rights to International Petroleum Co., Ltd., Toronto, Canada, during the year 1920. This form used a topping batch shell still to produce gasoline and kerosine for local use. The first shipment of these products was on Aug. 25, 1921, which means that their 30 year concession expired on Aug. 25, 1951. Empresa Colombiana de Petroleos (Ecopetrol) operates this property for the account of the Republica de Colombia since that date.

El Centro is about five miles north of Rio Colorado and near the geographical center of the existing oil field area. The Infantas oil field is a long narrow strip between these two points and averages about 1.25 miles in width. The La Cira oil field runs about 6.25 miles north of El Centro and averages about 3.75 miles in width. Up to the present time practically all production has come from the west side of two anticlinal structures known as Infantas and La Cira. Each structure has three distinct producing sands known as A, B and C-zone sands, the letters designating proximity of the surface in their respective order.

In the Infantas structure, the A and B-zone sands are largely exposed and are produced in only a small section of the structure. The C-zone sand is found at a depth varying from 400 to 2,400 feet and varies in thickness from 250 to 700 feet.

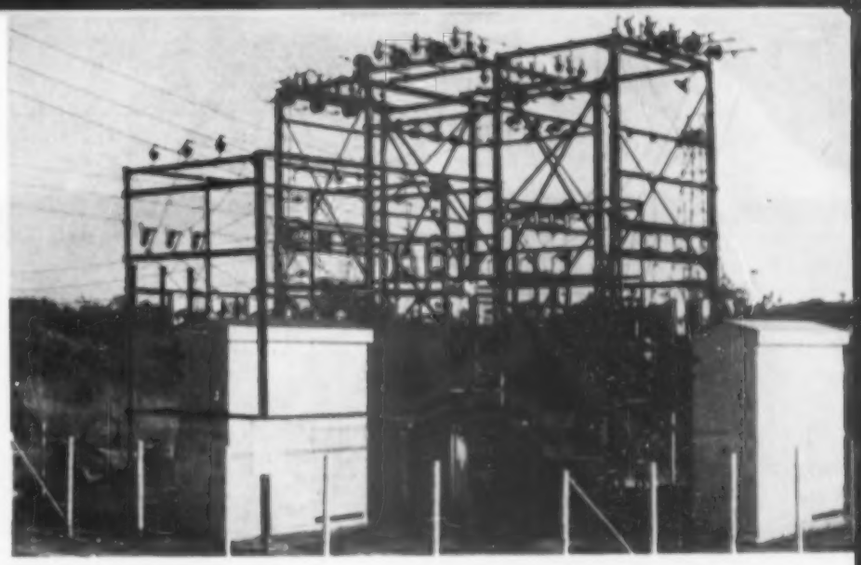
In the La Cira structure, the A-zone sand is encountered at a depth of 200 feet and the B-zone sand is found at a depth of 1,400 to 1,600 feet. The C-zone sand is found at depths of 2,300 feet near the crest of 4,600 feet along the flank of this oil field.

The oil from all three sands in both structures is of an asphaltic base, but there are variations in their physical properties that have some effect upon power requirements for pumping duty. Specific gravities and viscosities at 100° F. are as follows:

	Gravity Specific	API	Viscosity-100° F. Saybolt Seconds
Infantas			
A-Zone	.9333	20	300
B-Zone	.9091	24	200
C-Zone	.8917	27	100
La Cira			
A-Zone	.9396	19	400
B-Zone	.9091	24	300
C-Zone	.9032	25	250

Initially, 96 of the 35/15 hp, 1200/600 rpm, 440 volt, 3-phase 60-cycle dual rated squirrel cage induction motors with suitable control were purchased to be installed during the year of 1926 when the central power plant in El Centro was completed. Such a dual rated motor was developed during the year of 1912 to take the place of small steam engines belted to standard front of cable tool drilling equipment for well pumping and cleanout purposes.

The initial El Centro power plant contained five boilers, each rated 503 boiler hp at 238 psig, also, four non-condensing, single stage, steam turbine generators with direct connected exciters were installed at this time. Each of these units has a rating of 1,000 kw, 12,50 kva, 2,300 volts, 3,600 rpm, 3-phase, 60 cycles. Standard open-type switch gear in vogue during the year of 1926 was installed to provide 2,300-volt circuits to the adjacent oil field areas and to the El Centro industrial load and nearby



Transformer substation at the north end of the La Cira oil field which provides 13.2 kv take-off to the Barranca Bermeja oil refinery. Also the 13.2 kv oil field circuits are sectionalized at this point. The 2-300 kva 13,200-volt capacitor banks are located here.

ELECTRIFICATION

camps. A 2,000 kva bank of step-up transformers were installed to provide 13,200-volt power to more distant loads. The Anvian pipe line was ready for export shipment of oil at this time; that is during the year of 1926.

The load grew so rapidly that it was necessary to install another 2,000 kva bank of transformers to provide additional 13,200-volt services to outlying areas when the 5,000 kw condensing steam turbine-generator unit was added to the El Centro power plant during the year of 1931. Two more duplicate boilers with superheaters were added at this time and superheaters were also installed in the existing boilers. The superheat guarantee was 80° F. superheat at 130 percent rating and 110° F. superheat at 200 percent rating. The #4 (1,000 kw) non-condensing unit was moved to the power plant in the Barranca Bermeja oil refinery. This procedure provided space for a new air-compressor in the El Centro power plant. These two power plants were connected by a single-circuit 13,200-volt transmission line.

Initially, non-condensing steam turbines were installed in the El Centro power plant to eliminate the need for condenser circulating water which would, otherwise, come from the Rio Colorado water pump station located five miles away. Although this idea was and is commendable, it should be noted that more than twice as much steam was needed to serve the non-condensing steam turbines to develop the same power which could be provided by equivalent condensing units.

This situation is more or less a stand-off condition. Either use twice as many boilers or install a condenser and cooling tower provided with make-up water. The additional steam needed for non-condensing operation represent about 60 percent of cooling tower make-up water required when generating an equivalent load by the use of a condensing steam turbine generator unit. Furthermore, the cooling tower make-up water represents only about 15 percent of the water needed in other services such as for oil well drilling operations, gas plants and camps.

The 35/15 hp, 12,00/600 rpm oil well pumping motors operated at comparatively low efficiency and power factor owing to their dual rated design and because they were carrying about half-load. Consequently, in the year of 1931, it was decided to install double-gear reduction pumping-jacks having V-belt drives connected to small single rated motors for pumping duty only, and use portable well servicing rigs. Incidentally, it was during the year of 1928 when high starting torque, low starting current squirrel cage induction motors suitable for outdoor use were introduced to the market.

Since the retirement of the 35/15 hp motors for pumping service, oil well maintenance has been handled by portable equipment. All ordinary well servicing, such as pulling rods and tubing, is done by 40 and 60 hp, variable speed, wound rotor induction motors, driving single drum hoists. All such equipment is mounted on automobile trucks. Due to considerable sand trouble, frequent clean-out is necessary in some oil wells. Clean-out equipment is caterpillar mounted, double drum hoists, with spudding and rotary attachments.

The approximate number of oil well pumping motors installed in the Infantas-La Cira area were as follows:

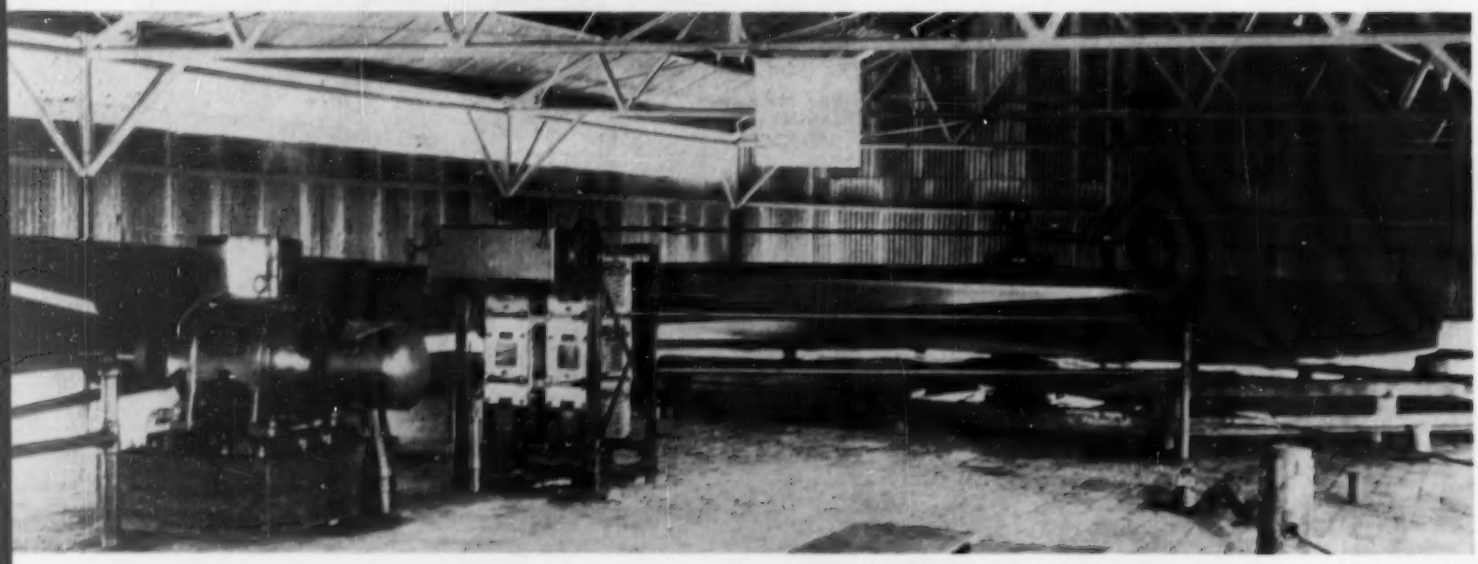
	Dual Rated Motors		Single Rated Motors	
Year	*New Total*	*No. Used*	*New Total*	*No. Used*
1926	96	96		
1931		90	110	110
1933		70	80	190
1935		35	155	345
1937		5	200	550
1939			150	700
1941			90	790
1943			90	880
1945			0	880
1947			20	900
1949			80	980
1951			60	1040
1953			30	1070

Motor Application: When the first pumping jacks were installed in the field they were powered with motors of sufficient size to handle the maximum output requirements of the pumping unit. This practice continued until the year of 1932. Increasing motor applications on oil wells and well servicing equipment began to be a dominant factor in requirements on the power distribution system. At this period a power survey was made on representative pumping equipment. The survey showed such a variance between the actual power requirements and the sizes of the motors at the oil wells that a more thorough study of these applications was made to determine the power saving possibilities. The production department uses a hook-on ammeter when adjusting counter-weights.

A division of the electrical department was set up to handle the load testing of motors on individual pumping oil wells. At first, the actual test work was done by a staff employee, but later, Colombian workmen have been trained to make the actual tests. Load testing became a part of the regular operating routine.

Test instruments: A graphic (roll chart, adjustable speed) wattmeter, voltmeter, and an integrating watthour meter were used in making the load tests. The watthour meter has a double throw switch attached and so connected that by throwing the switch to the right hand position and with a stop watch timing of the number of revolutions of the aluminum disc in the watthour meter, the load kilowatts may be computed. Reactive kilovoltampers may be computed from data obtained in like manner, but with the double throw switch in the left hand position. The voltage should be checked for each test. The graphic wattmeter is for the purpose of determining the starting characteristics of the load and the counter-weight balance of the pumping unit.

Fast speed of the chart in the graphic wattmeter separates the power stroke from the counter-weight stroke of the polish-rod for immediate study, and proper adjustment of the counter-weight on the pumping jack. Such charts may be interpreted



Electric motor driven band wheel which provides pumping power for about 30 oil wells.

by practice of show conditions as follows:

(1) Unbalance as against broken rod.
(2) Bad foot valve.
(3) Leaky pump.
(4) Tendency of wells to sand-up.
(5) Bad gearing in pumping unit.
(6) Starting torques and overloads.
(7) Gasification and fluid column changes.
(8) Belt slip when starting unit.

A test on a specific oil well equipment location using 15 hp, 1,200 rpm normal-torque squirrel cage induction motor caused it to be replaced by a 7½ hp, 1,200 rpm high starting torque (high reactance), low starting current motor. Comparative test data at this well was as follows:

	15 hp Motor T. C. Lufkin #4-11	7½ hp Motor Same
Pumping-jack Strokes per minute	19.0	19.0
Kw input	4.05	3.69
Rkva input	6.13	3.66
Kva input	7.35	5.10
Power-factor	55.2%	72.5%
Voltage	456.0	456.0

Motor sizes: Such close application of motor sizes to pumping-jack loads in an oil field may reduce total installed hp as much as 35 percent: that is 5,200 hp may do the work performed by an 8,000 hp installation. This saving may represent 15 percent of total power generation for the oil field area. It may be interesting to note the sizes and the number of each size of motors used for oil well pumping duty in the Infantas-La Cira oil field about 20 years ago as follows:

RATINGS		NUMBER OF MOTORS		
HP	RPM	Service	Stock	Total
1	*GM	1	3	4
2	GM	3	1	4
3	GM	3	0	3
1	1,200	13	4	17
2	1,200	20	2	22
3	1,200	99	1	100
5	1,200	179	28	207
7½	1,200	146	27	173
10	1,200	72	10	82
15	1,200	82	6	88
20	1,200	10	3	13
35	1,200	1	0	1
10	900	7	3	10
15	900	2	24	26
60	900	1	0	1
		639	112	751

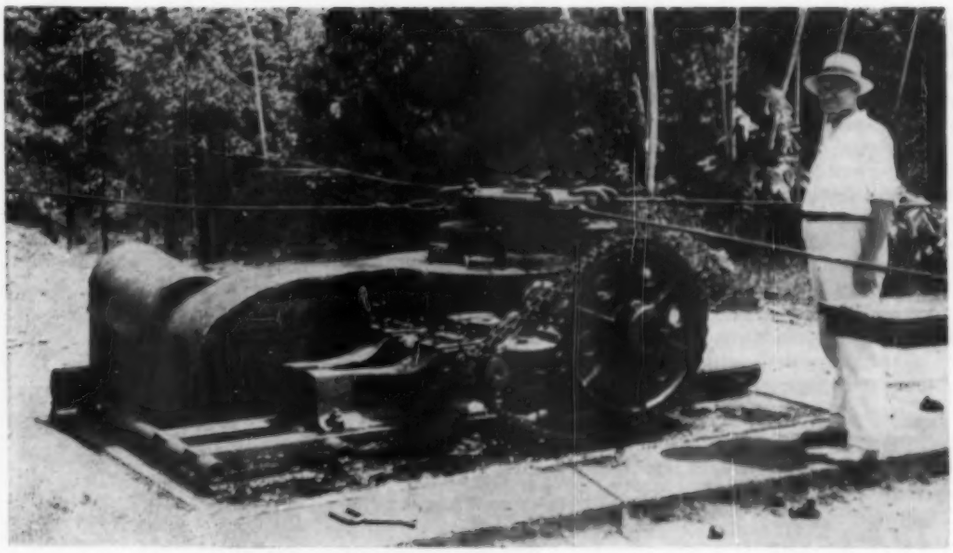
*GM-gear motors applied to low gear ratio pumping jacks.
Note: 7.29 hp was the average installed motor hp at the pumping wells.

Motor speed: For standardization, simplification of pulley sizes, and efficiency; a motor speed of 1,200 rpm was indicated as most suitable for polish rod strokes per minute being used. Although 1,800 rpm motor speed gives a more efficient 60-cycle motor, this speed is too high for practical application of belt drives in this case. Speeds less than 1,200 rpm produce motors of correspondingly lower efficiencies. If a gear-motor is used, it should have a gear of the heavy duty design owing to the pulsating load on the pumping-jack. Sheave pulleys should have minimum number of grooves for V-belt use to prevent excessive overhang on the motor shaft. Production of pumping wells varies from five barrels to 400 barrels of fluid per day. These figures together with the range of 200 to 4,600 feet of depth of the oil wells explains the range of motor sizes in the foregoing tabulation:

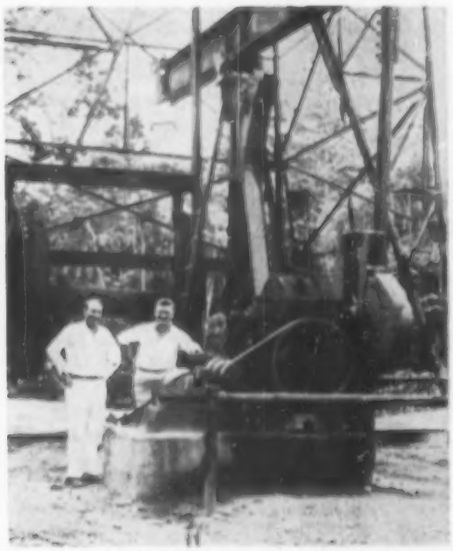
A study of motor application of pumping jacks is shown in Table I.

Motor Control: A standard electrical control installation on a pumping well in the field consists of a well service steel cabinet which contains the motor control equipment and disconnecting switches, underground cable from the service cabinet to the motor, and another cable from the service cabinet to the rig for lighting services. Such a service cabinet is a watertight steel box adapted for pole mounting. Enclosed in it are all main switches, lightning arresters, relays and motor control equipment. There are three circuits; one plug receptacle circuit for portable well servicing equipment, one control circuit for the pumping motor, and the lighting cricuit. Tests links are provided in the main circuit to facilitate connections of load testing instruments. Operation is from a pushbutton station accessible outside of the cabinet and, as the overload relays automatically reset after a trip-out, pumpers and unauthorized persons are never required to open the cabinet cover.

Electric Power Uses: The use of electric power is not limited to pumping oil wells in the Infantas-La Cira oil field area. All pipe line pumping from the field gathering stations to storage and to the dehydration plants is done by 15 and 25 hp motors. These motors are general purpose motors with reduced voltage starting equipment. Also, about 2,000,000 gallons of water per day is pumped by 75 and 200 hp general purpose motors directly connected to centrifugal pumps. Furthermore, gas plants, shops and camps are supplied with electrical power. Allocation of such loads may be represented as follows:



Old turn table of drilling rig driven by an electric motor to provide power to several oil wells for pumping duty.



The author is pointing to the small electric motor which drives the heavy duty pumping jack. The other man, J. D. Woodbury, was the oil field electrical superintendent in July, 1935.

	Kw	Kva
Oil well pumps	2,000	3,200
Oil gathering stations	400	500
Water pumps	400	470
Gas Plants	1,000	1,200
Industrial area	320	450
Camps & miscellaneous	600	650
Power stations auxiliaries	280	350
Power generation	5,000	6,100

This tabulation is a typical load distribution from the El Centro power plant. Summation of these loads is practically full load for the 5,000 kw condensing unit. The existing non-condensing units did not represent full stand-by capacity; that is, there was some calculated risk in this situation. However, these units together with crude oil tank storage provided stand-by operation for planned maintenance on the 5,000 kw condensing unit.

Observations by the author: The first visit of the writer to the Infantas-La Cira oil fields was during July and August of the year 1935. The flight from Barranquilla to Barranca Bermeja was in a small, single engine seaplane that followed the Rio Magdalena and stopped at several river ports. The ride from Barranca Bermeja to El Centro was on a narrow gauge railroad which is not in existence today. This leg of the trip was for a distance of 17½ miles. Although the total trip took one day, it would have required about ten days on a stern-wheel driven river boat going upstream, the length of time depending upon the stage of the river.

Experiences in this unique oil field area were interesting even though the climate was humid and hot. Records show that the humidity was 100 percent between two and five each morning throughout each year. Also, the average rain fall was and is about 125 inches of rain per year. The air temperature records were studied and found to be very uniform for each corresponding hour in each 24 hour day throughout the year. The minimum temperature was found to be 70° F. but the maximum temperature was 97° F.

The crooked roads in this low altitude hilly country area were cut through heavy tropical jungle growth which includes tall trees such as mahogany, chicle, and tree ferns. A naturalist was collecting large beetles, gorgeous butterflies, and many varieties of orchid plants. The geologists told big fish stories about manatees or sea cows in the Sagamoso swamp at the northern boundary of the Concesion De Mares. Also a large boa snake, a sloth, and other wild animals were brought into camp at El Centro. A crew of Colombian workmen are kept busy spreading oil on water ponds and ditches to eliminate mosquitoes. Another crew uses machetes to keep the right-of-way along the roads and power lines clear of rapidly growing jungle. In many ways, the Infantas-La Cira oil fields were isolated which meant that the camps had to be self contained with respect to daily need such as houses, churches, stores, hospitals, laundry, electric power, telephones, schools, clubs, water and sewage systems.

The management showed much resourcefulness in the way it used scrap materials. Most of the power line poles in the oil field were of A-frame form made from scrap pipe and iron channels. The counter weights on the pumping jacks looked like wheelbarrow type of iron pans or steel barrels filled with scrap iron. In some places, worn out drilling turn tables were used to drive two or more pumping rigs through pull rods.

Nearly all of the pumping wells are equipped with individual gear-type pumping units. These vary in size and type according to the depth and capacity of the well. There are two central powers operating some 30 wells, but their inflexibility and the ruggedness of the terrain has discouraged extensive use of this type of lift. There are a number of back-crank installations where an A or B-zone well is pumped on the backside of a C-zone unit. This is usually done without having to increase the size of the motor on the original installation.

It was noted that the 13,200-volt system was being operated without grounded neutral protection. Originally, this system was operated with the neutrals of the step-up banks of transformers being solidly grounded, but large birds, snakes, monkeys and other animals on the cross-arms at the top of the poles caused frequent outages. Consequently, these ground connections were removed. A study was made for the use of a Petersen Coil (ground fault neutralizer) to provide better system protection, but the 13.2 kv system mileage was too small to provide positive action at that time. Perhaps, such a coil will be added soon.

The electrical superintendent and power plant foreman requested certain equipment improvements which the writer checked and recommended to management. Such improvements were as follows:

(1) Add ample size of de-aerator type of boiler feed water heater.

(2) Add hot process feed water softening equipment of ample capacity.

(3) Extend boiler furnace front about five feet to provide better natural gas fuel firing conditions with much less excess air.

(4) The "Dutch Oven" type of furnace

should have four gas burners instead of three of existing type.

(5) Add boiler meters and indicators.

(6) Improve turbine condenser cooling water treatment to inhibit algae more effectively.

(7) Replace obsolete lightning arresters with modern ones.

(8) Strategically place banks of capacitors to improve system power-factor so as to have better system voltage regulation attendant to more generation and transmittal of power: two 300 kva, 13,200 volts; one 150 kva, 13,200 volts; two 120 kva, 2,300 volts; two 45 kva, 2,300 volts and 1,080 kva in capacitors.

These 3-phase, 60-cycle capacitor banks were installed with their controls near the far end of the 2.3 and 13.2 kv transmission lines as the most effective locations at these voltages. Their equivalent total capacity distributed at the motor terminals would improve voltage regulation in the 480-volt systems and reduce kva loading of the distribution transformers as well as in the 2.3 and 13.2 kv lines and at the power plant. Theoretically, the place to correct power factor is at its source; namely at the induction motor terminals. Of course, many factors are involved in this decision such as size of motors and power cost at the motor.

The steam boiler performance was improved as predicted owing to the listed additions and modifications. The abnormal boiler maintenance became normal with respect to like boiler plants. Also, fuel gas pressure needed at the burners was reduced ten percent and the boiler draft was reduced 60 percent which means that much better firing conditions were attained. These boiler improvements enabled them to generate 20 percent more steam easily; that is five boilers instead of six boilers were then needed to carry the El Centro load. The "Dutch Oven" addition to the furnace fronts of the boilers and conditioned boiler feed water permitted better performance recapitulated as follows:

1. Furnace temperature increased from 1,800 to 2,250° F.

2. Much greater turbulence in the boiler furnaces.

3. Draft for complete combustion was lowered greatly.

4. Much higher carbon dioxide in the third pass of the boilers, now nine to 11 percent.

5. Better control of excess air, now 35 to 15 percent.

6. No flame impingement on boiler heating surface.

7. Higher boiler output for less gas fuel and less draft.

8. Normal boiler efficiency of 75 percent attained in the existing type of boiler.

9. Each boiler absorbed 4,735 Btu of heat per square foot of heating surface per hour to evaporate 4.636 pounds of water per square foot of this surface.

10. Additional six percent of heat absorbed in the boiler superheaters.

11. Each boiler liberated 18,000 Btu of heat per cubic foot of its furnace volume.

It is seen that these small boilers performed very well after their operating conditions were improved. In fact, it is believed that their life was extended more than 20 years by such additions to the boiler plant. Also, the boiler plant life extension could be increased further by realigning the boilers to each other, but that would mean to shut down the boiler plant for many months or use a much more expensive procedure in so far as the power plant is concerned.

Carrier Current Oil Well Control: The electrical superintendent was always looking for ways and means to increase the usefulness of the El Centro power system. This individual found an advertisement in a technical magazine about the application of a simple relay to control off-peak power to household hot water heaters by means of a 480/720 cycle carrier current system superimposed on the existing power distribution system.

TABLE I

Double Reduction Pumping Jack Gear S-40-20

Capacity of 40.1-HP at 20-SPM and 198,000 pounds torque.
Overall Ratio—19.6:1
Driven Sheave—40" max. dia. with max. of 6-D belts
Motor (double squirrel-cage)—
Rating Range of 7½ to 25HP at 900 (875) RPM

SPM of Polished Rod	10.1	11.1	12.3	13.4	14.0	15.0	16.2
Driven Sheave RPM	196	218	240	263	274	294	318
Sheave Diameter—Inches	40	40	40	40	40	40	40
FPM Speed of Belt	2050	2280	2520	2760	2870	3080	3330
Motor Sheave Dia.—Inches	9.0	10.0	11.0	12.0	12.5	13.5	14.5
V-belt Number & Size							
* 25 HP	6-C	6-C	5-C	4-C	4-C	4-C	4-C
15 HP	4-C	4-C	3-C	3-C	3-C	3-C	2-C
7½ HP	2-C	2-C	2-C	2-C	2-C	2-C	1-C

* A 35 HP — 300 RPM internal combustion engine would require 7-C or 4-D belts throughout this range.

Double Reduction Pumping Jack Gear J-30-33

Capacity of 47.6-HP at 20-SPM and 236,000 pounds torque.
Overall Ratio—33.5:1
Driven Sheave—46" max. dia. with max. of 5-D belts.
Motor (double squirrel-cage) — **
Rating Range of 7½ to 25HP at 1200 (1165) RPM

SPM of Polish Rod	9.8	11.0	12.0	13.0	14.0	15.0	16.2	16.8
Driven Sheave RPM	329	368	402	433	469	502	543	562
Sheave Diameter—Inches	46	46	46	36	36	36	30	30
FPM Speed of Belt	3970	4440	4850	4100	4420	4730	4260	4410
Motor Sheave Dia.—Inches	13.0	14.5	16.0	13.5	14.5	15.5	14.0	14.5
V-belt Number & Size—								
25 HP	3-C	3-C	3-C	3-C	3-C	3-C	3-C	3-C
15 HP	2-C	2-C	2-C	2-C	2-C	2-C	2-C	2-C
7½ HP	1-C	1-C	1-C	1-C	1-C	1-C	1-C	1-C
SPM of Polish Rod	18.0	18.8	20.3	21.0	21.8	23.2	24.4	25.2
Driven Sheave RPM	602	630	680	703	728	776	815	842
Sheave Diameter—Inches	30	24	24	24	24	24	20	20
FPM Speed of Belt	4740	3960	4270	4420	4580	4880	4270	4420
Motor Sheave Dia.—Inches	15.5	13.0	14.0	14.5	15.0	16.0	14.0	14.5
V-belt Number & Size—								
25 HP	3-C	3-C	3-C	3-C	3-C	3-C	3-C	3-C

** An 1800 RPM motor may be used to advantage for polish-rod operation above 25 strokes per minute.

Frequent lightning storms caused many pumping-jack motors to shut down. The district or farm foremen would have to travel over their assigned area to restart these motors. If lightning caused these motors to shut down at night, the farm foremen did not get all of them restarted until mid-morning of the following day. Of course, much crude oil production was lost on this account. Here seemed to be the place to use such a simple relay controlled from El Centro power plant.

However, the problem was not so simple since the new relay had to be coordinated with the existing motor control devices and relays. In fact, two new relays were needed for such coordination. The result involved much development engineering work on two commercial relays to modify them to fit this application. One of the conditions to be met was to stagger the starting time of the motors such that reduced starting KVA would be carried by the distribution transformers at any given instant.

The initial installation was for controlling 400 oil well pumping motors from the power plant. The field devices consisted of carrier current relays, time selecting relays, and selector switches; that is, one of each of these three devices had to be mounted in each motor control cabinet and wired into the existing motor control circuits. Traps were installed across the step-up transformers at the power house. The new equipment installed in the power house consisted of a three unit motor generator set and control panels to provide the 480/720 cycle control power to be superimposed on the existing power transmission system.

This carrier current system has been credited with the enhancement of crude oil production owing to reduced time of outages of power to the pumping jack motors. The writer has no knowledge of a similar carrier current control system installed in any other oil field in the world. Of course, there are automatic restarting relays located at individual oil wells in some oil fields, but none for remote control operation from a control center such as the central power plant.

Generator Relay Protection: An overcurrent relay equipped with a voltage restraining coil was placed on the market about the year of 1948 to meet the growing need for generator automatic protection which would distinguish the difference between a short circuit current and an overhead current. One of these relays was added to the El Centro 5,000 wattsteam turbine generator circuit at this time.

European practice has been to apply overcurrent relays to generator circuits to favor the generator even though this means to loose the load; whereas, the practice in the U.S.A. has been to hold the load even though this means to abuse the generator. In other words, continuity-of-service seems to mean more in the U.S.A.

Oil Refinery: Although the De Mares concession reverted to the Colombian government at midnight on Aug. 25, 1951; the International Petroleum Company de Colombia, Ltd., (Intercol) obtained a lease to operate the Barranca Bermeja oil refinery for another ten years to provide products for their trade in Colombia and for export. Two months later, the writer was in Barranca Bermeja to collaborate with the contractor engineers relative to the new power plant being incorporated as a part of the government program to modernize and enlarge this oil refinery to a nominal throughput of 35,000 b/d.

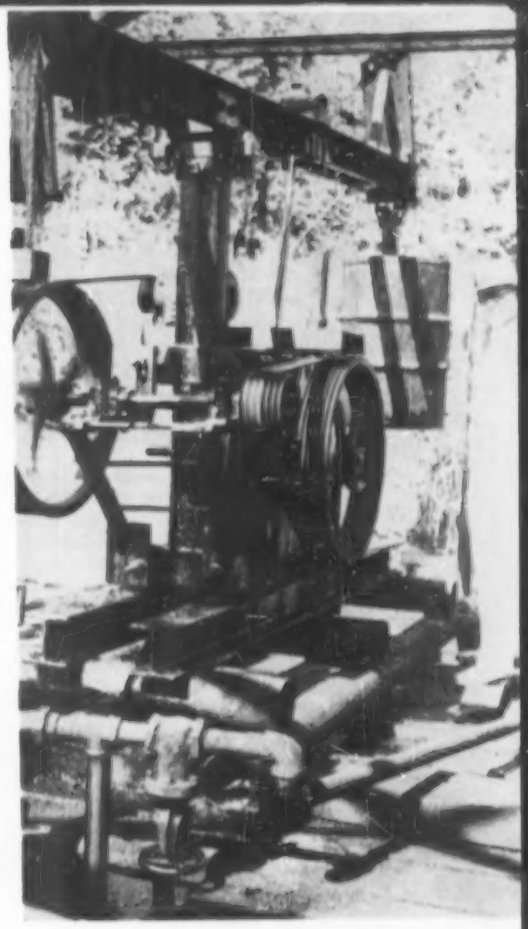
The engineering studies resulted in the choice of three extraction-condensing steam turbine generator units, one being a spare and each one being rated 3,500 kw, 4,375 kva, 3,600 rpm, 2,400 volts, 3-phase, 60 cycle and having direct connected exciter. The units were to receive steam at 400 psig, and 750° F. total temperature. Also, they were to extract process steam at 170 psig and exhaust to the condenser at three inches of mercury absolute back pressure.

The existing distribution system operated 2,300 volts which was the reason for choosing 2,400 volts as the new generator voltage even though it should be higher owing to the size of the new power plant. To generate so much power at 2,400 volts made it necessary to incorporate a synchronizing bus scheme into the new power plant bus so as to restrict the interrupting capacity requirements to standard commercial circuit breaker ratings.

The 13.2 kv transmission line between the oil refinery and El Centro was rebuilt to operate at 33 kv with suitable new power transformers at each end of this line. The object was to provide full spare unit service of 3,500 kw, 4,375 kva to El Centro. This unit together with the three 1,000 kw noncondensing units in El Centro could provide full stand-by service for the 5,000 kw condensing unit in El Centro. It should be noted that the peak load was approximately 6,800 kw.

New Power plant for El Centro: While the refinery program was being completed during the year of 1954, the writer entered a consulting engineering service contract to study power needs in the Infantas-La Cira oil field area and arrive at a definite recommendation for the type and size of a new power plant to replace the old and obsolete one in El Centro. In addition to retiring much of the old power generating equipment the new power plant should be suitable for the future load which may range from 8,000 kw to as much as 20,000 kw. The Concesion de Mares contains several geological areas which are being or are to be exploited in search of more crude oil in commercial quantities.

The overall electrical power study included an extraction-condensing steam turbine plant with respect to an equivalent gas combustion turbine plant equipped with waste heat boilers and with respect to an equivalent internal combustion engine plant with fuel fired boilers to supply 40,000 to 60,000 pounds of steam per hour to the El Centro gas plant and to the shops. Overall economics came out in favor of adding two 5,000 kwt, 6,250 kva, 3-phase, 60 cycle, 13,800 volt rated gas combustion turbine generator units with direct connected exciters and with a waste heat boiler per turbine.



Electric motor behind the pumping jack post drives this low gear rationpumping jack through V-belts and idler shaft. In this case the counter weight is shown to be a steel barrel partly filled with scrap iron.

Ecopetrol decided to add auxiliary full firing equipment to these waste heat boilers to provide additional steam for the operation of the existing 5,000 kw condensing steam turbine generator unit. This procedure could leave one of the gas combustion turbine units as a spare for the time being or provide stand-by service for either one of them. Furthermore, the 33kv system may be extended considerably.

Existing power plant switchgear is obsolete and inadequate which means that it should be replaced by modern switchgear combined with other new power plant control equipment and installed in the new power house extension. The existing 5,000 kw unit is in the past end of the old power house. This end of the plant is to be extended northward to house the new power plant equipment with provision for further extension when needed.

The Infantas-La Cira oil field area probably is the most completely electrified oil field in the world. Furthermore, it represents the whole range of electrical progress in all oil fields.

J. A. Bierbaum

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W. J. Faust

W. J. Faust received his B. S. degree in chemical engineering from the University of Wisconsin in 1940 and joined Universal Oil Products Company in that year. He served with the United States Air Force from 1943-1946. Mr. Faust is with the research and development laboratories in Riverside, Illinois. Since 1952 he has been head of the automotive and aircraft division.

'56 CARS dent the octane cushion

By W. J. Faust and J. A. Bierbaum

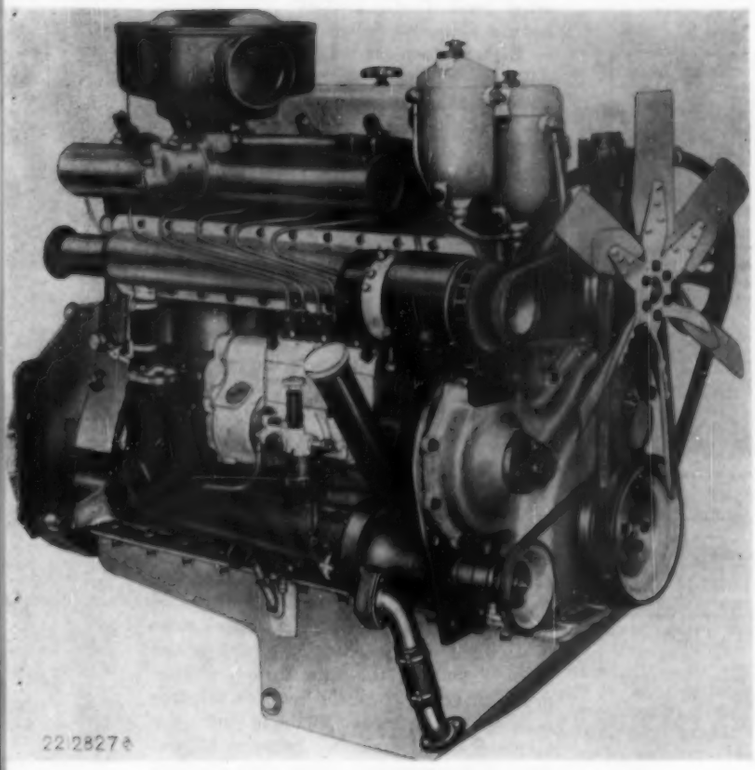
The demands of the 1956 automotive engines very probably will wipe out the two octane number differential existing between gasoline now available at the service station pump and the octane requirement of the 1955 automobiles. This stems from the fact that auto manufacturers are continuing their efforts to utilize all the gasoline quality made available by the refiners.

Tests indicate that 90% of the 1955 model cars now in use have an octane requirement of less than 94. Refiners provide a two-octane number cushion between this requirement and the gasoline supply late in the year as indicated by the fact that the weighted average octane rating for premium now available in service stations is 96 Research. If the refining industry continues the unprecedented rate of quality improvement which has been achieved over the past 30 months in supplying ever-higher octane number gasolines, a differential may again be expected to develop towards the end of 1956.

The above data indicate that the high-requirement vehicles were taken care of quite well in 1955, but they do not show that 67% of 1955 car buyers needed to drive to the premium pump. Such was the case, since only 33% of the 1955 models were satisfied by the weighted average of 88.4 Research octane number for regular gasoline. This situation is shown graphically by Figure 1, which is a plot of the weighted average Research octane ratings of regular and premium grades from 1950 through 1955, along with the average requirements, derived from Coordinating Research Council tests, for the stated percentages of new engine models which have been introduced.

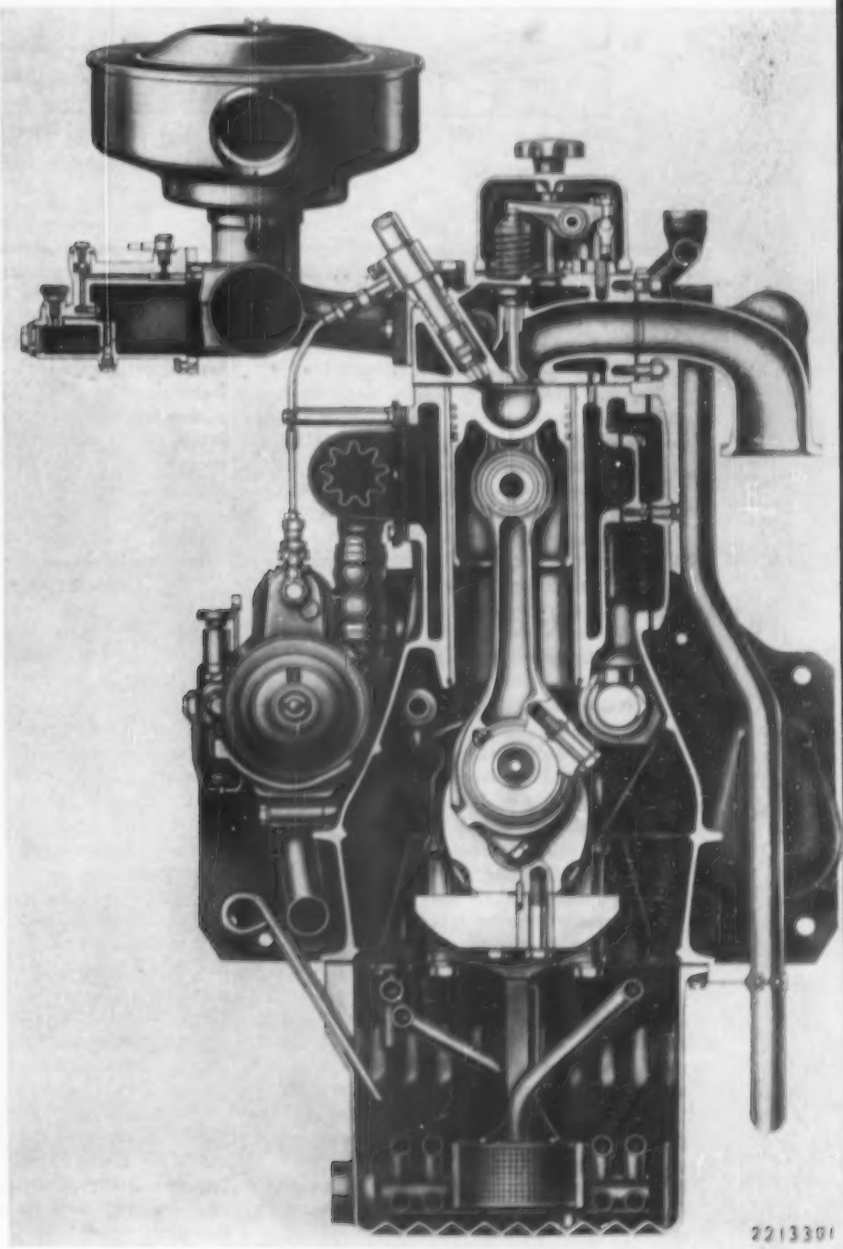
As in the past, the refiner in 1956 probably will again exercise the choice of tailoring his premium and regular gasolines to fall somewhere in a projection of the shaded areas of Figure 1. If he produces gasolines in the top of these areas, he has adopted the philosophy of marketing gasoline which will satisfy the '56 cars with about 35% using premium and the remainder using regular. If, instead, his choise is based on the engine requirements of the entire car population, including the older models, then the octane ratings of his premium and regular gasolines will fall in the lower portion of the shaded areas. In this latter marketing approach about 90% of the '56 cars could be satisfied from an octane standpoint by the use of premium gasoline. Theoretically it puts the decision in the customer's hands as to whether or not he wants to pay the premium price for 96 plus octane number gasoline to satisfy his new car's engine requirement which may actually be somewhat below the premium level, but above the regular level.

More new car buyers are purchasing premium gasoline as evidenced by the increase in the sales of this material. Whether



Left: The new MAN "Whisper" diesel engine, developed by Dr. J. S. Meurer and which is expected to be introduced soon in the United States by Maschinenfabrik Augsburg Nurnberg Co. of Germany. Dr. Meurer has discovered a new method for combustion mixture formation that upsets some basic ideas long accepted as "gospel" by engine designers. The possibility of applying some of Dr. Meurer's new principles to spark-ignition engines has caused some excitement among Otto-cycle men.

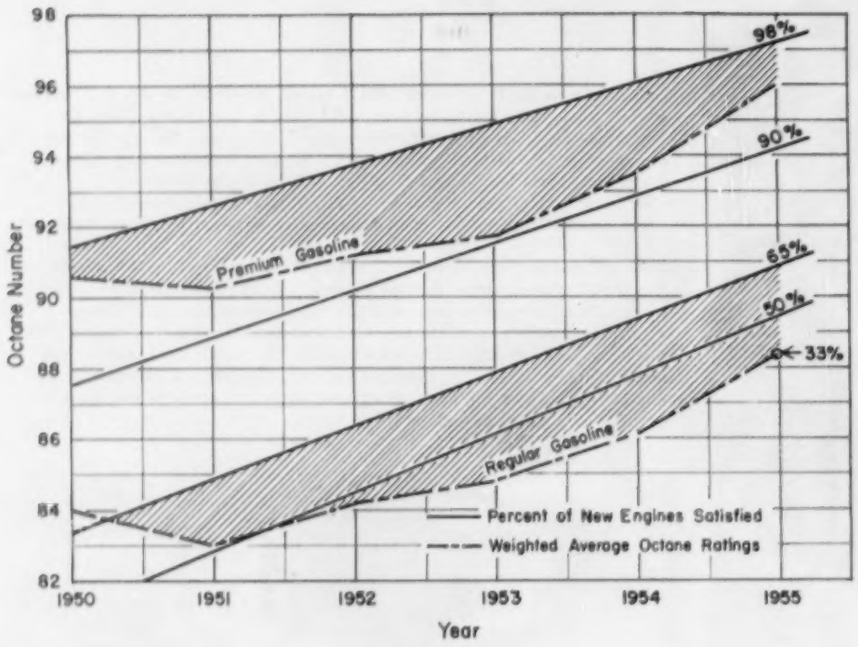
Below: Cross sectional drawing of the MAN diesel engine which shows the secret of the engine. Instead of atomizing the fuel into a fine mist—up to now the prime ambition of all diesel designers, Dr. J. S. Meurer sprays it onto the wall of the ball shaped combustion chamber located within the piston and vaporizes it by an air swirl. The fuel is thus gasified and mixes better with the air. Result: Combustion knock and smoke are eliminated and the engine is so efficient that it drives a 10 ton truck 20 miles on a gallon of fuel.



or not this trend toward increased premium sales will persist is probably largely dependent on the spread in octane rating which will prevail in the future between the two grades as well as on the octane level selected by the refiner for marketing. Increased premium sales in recent years are due not only to an increase in the number of high-requirement cars but as well to the increase in octane rating differential between premium and regular. Over a period of five years this differential increased from 6.5 to 7.6 units. Historically, however, the oil industry has endeavored to improve the quality of both premium and regular gasolines and for competitive reasons the volume ratio between the two grades probably will not change materially.

One peculiarity of gasoline marketing which causes auto builders understandable concern, and which makes them look warily at the aforementioned statistical two-octane cushion, is the practice of selling gasolines in some parts of the United States which rate two or three octane numbers below that sold in other sections of the country. This condition makes it difficult to match the requirements of cars, which are manufactured on a national basis, to gasoline quality, which is controlled locally.

Another trend which has developed concurrently with the increase in octane ratings has been the increase in sensitivity or "jump" (spread between Research and Motor Method ratings) of premium gasoline. In the last five years, sensitivity has



increased from 8.0 to 9.7 units. This increase in sensitivity is beginning to cause concern to some automobile builders as they approach the point at which high speed performance may be limited by knock.

The evaluation of a fuel's high-speed performance, however, should be made from full-scale engine tests rather than by laboratory tests alone. Experience in Universal's laboratory has been confirmed in a recent paper[1] given before the California Natural Gasoline Association, wherein Ethyl Corporation reported that road performance was not accurately predicted by mere measurement of sensitivity with laboratory engines. This finding is the result of an extensive road-rating program which showed that road performance is greatly affected by hydrocarbon composition of the fuel and other factors which are not determined by laboratory engine tests.

Arbitrary use of a Motor Method specification in conjunction with the Research rating could easily lead to the waste of high speed anti-knock quality, because these tests will not necessarily predict road performance. The only way high-speed performance can be adequately determined at the present time is by actually road-rating each particular gasoline.

Depending on where in the shaded areas of Fig. 1 the individual refiner elects to place the octane rating of his premium blend, he will find he is gradually losing the premium blending value of catalytic polymer and catalytic cracked gasolines. In addition, catalytic reforming operations are gradually being increased in severity, creating the need to sell or otherwise dispose of more and more of the refineries butanes, because these high vapor pressure stocks cannot be completely blended off into gasolines. A considerable volume of these butanes is actually isobutane, which could be utilized in an alkylation unit. Processing isobutane in an alkylation unit along with the refinery propylene and butylenes is an excellent way to use this isobutane. Complete utilization of both the olefins and isobutane are obtained in alkylation. Most refineries processing all of their olefins in alkylation units will find it necessary to import some isobutane. Isobutane is becoming more abundant as catalytic reforming units are put into operation. Eventually, isomerization of the normal butane present in the refinery or in low price field butanes will be more widely practiced.

There has been considerable speculation as to the imminence of fuel injection which is claimed to permit use of fuels of greatly increased volatility and higher end point. The automotive industry is carefully investigating the merits of fuel injection but is reportedly far from reaching any final conclusions. Engine builders apparently are not convinced that injection holds all the advantages which have been claimed for it in recent months. There appears to be in prospect no substantial change in the fuel volatility specifications, which now prevent the direct utilization of all the available butanes.

Not only does alkylation help the refiner solve his volatility problem but it assists from a gasoline quality standpoint. Premium blends of Platformate, catalytic cracked gasoline, polymer, butanes and minor amounts of other components now are being made. In this type of blend the octane numbers contributed by the polymer are very near its actual rating of 99 Research when leaded with 3cc of tetraethyl lead. C_3-C_4 alkylate will actually have a Research rating equivalent to 101 or higher when leaded with 3cc of TEL. Alkylate generally blends arithmetically with the other components in the gasoline pool.

At the same time, replacing polymer with alkylate would decrease sensitivity and increase the percentage of isoparaffins. Inherently alkylate has nearly identical octane ratings by either the Motor or Research methods and, therefore, would impart to the blend less sensitivity. The clean-burning characteristics would add to the octane requirement control which already has been achieved in part by the petroleum industry through the use of lower-boiling lubricating oils.

In general a refiner with a catalytic cracking unit and a catalytic reformer will find that if the propylene and butylenes are processed in an alkylation unit, about 15% of his gasoline pool will be alkylate. Whether he markets a premium gasoline of 98 plus octane in 1956 or later, an alkylation unit will help considerably in producing these octanes profitably. Gasoline sales predictions indicate about 35 to 40% of the gasoline sold in the near future will be premium grade. If all the refiner's alkylate is used for premium blending then the alkylate would make up between 37 and 43% of the premium blend with Platformate, catalytic cracked gasoline and normal butane (or isopentane) providing the remainder. A blend of this type in most refineries will make the 98 plus octane with the addition of tetraethyl lead. In this refinery the regular blend will be made with the excess of catalytic gasolines not needed in premium blending and whatever other gasoline stocks are available.

The refiner whose catalytic cracked gasoline rates significantly below 97 Research will have to rely entirely on his catalytic reformer for the base stock for his premium gasoline, and will use most of his catalytic cracked gasoline in regular grade. Even in this case the alkylation unit helps considerably since the reformate can be two to three octane numbers lower when all of the refinery alkylate is used in the premium blend.

A number of alkylation units were installed and operating during and after World War II and the Korean War to produce aviation gasoline. These units are known to have been relatively high investment cost facilities. Universal Oil Products Company, utilizing the regenerability of hydrofluoric acid, a large background of operating experience and improved design, can now supply a low investment and operating cost "HF" Alkylation unit for making motor alkylate. These reductions in cost, coupled with the conversion to high octane gasoline of excess refinery isobutane, have made the installation of such "HF" Alkylation units economically attractive to a number of refiners.

1. Buerstetta, F. D. and Warren, T. W., "Octane Possibilities with C_3-C_4 Hydrocarbons," presented before California Natural Gasoline Assn., Los Angeles, Oct. 12-13, 1955.

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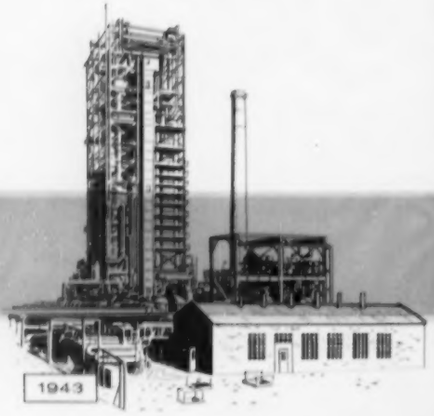

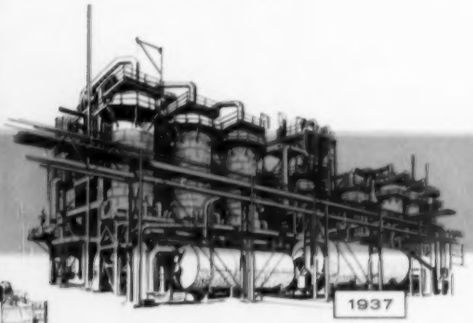

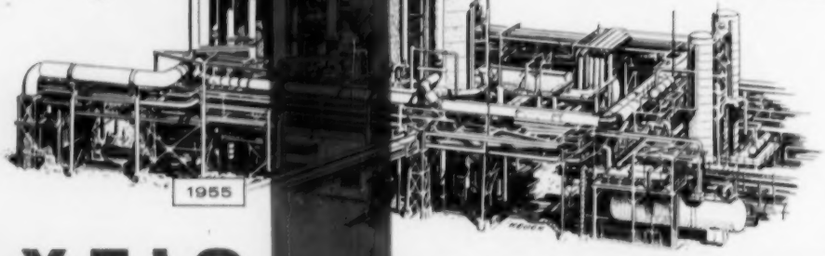

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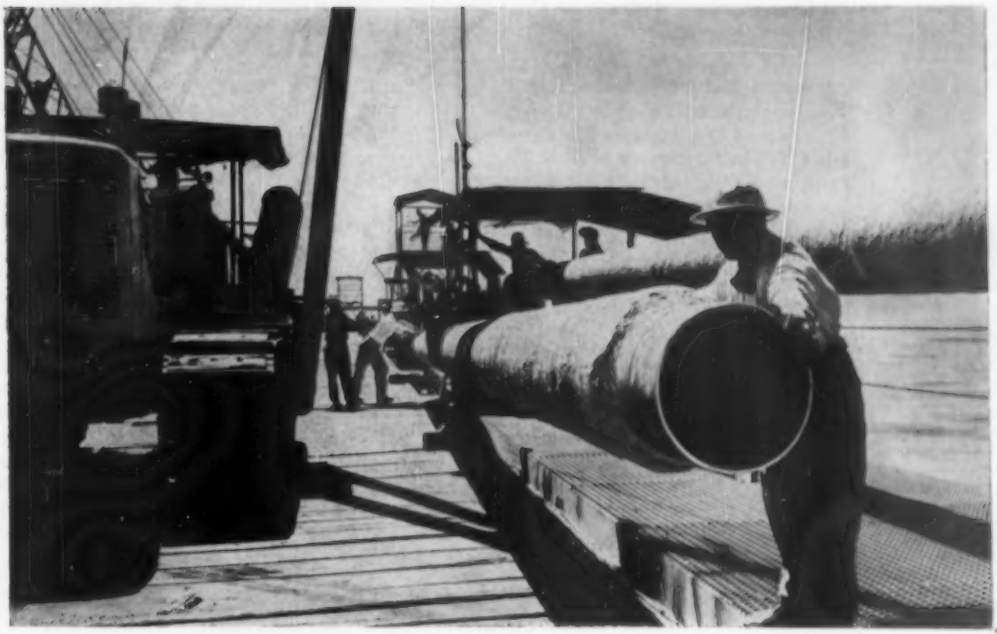
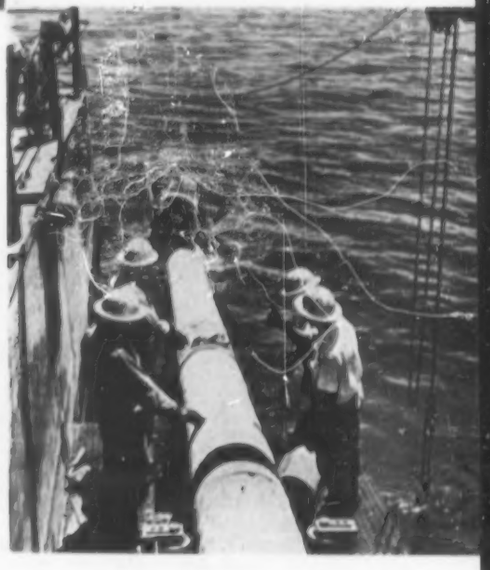


On the laying barge an "assembly line" technique has been adopted. Firstly, the pipe lengths are lined up ready for welding.

Lowering the submarine line into the water. Pontoons, which control the buoyancy and prevent damage or undue stress, are released when the line settles on the lake floor.



LAPLINE LAID IN LAKE MARACAIBO

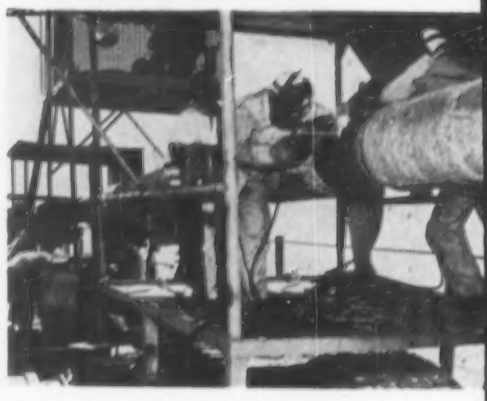
UNTIL recently small tankers were used by Compania Shell de Venezuela to move its Lake Maracaibo production to shore installations. These have been replaced with the "Lapline," a 45 mile long Lake wells to Shell's shore loading terminal at Palmarejo, on the west side of Lake Maracaibo.

The new pipe line is in two sections. From a platform set up in 70 feet of water its submarine section, which is connected to the underwater gathering lines from the wells, extends shorewards for 18½ miles. It emerges at La Ensenada to connect with the land section which continues for 26½ miles to Palmarejo.

Cost some $7 million to build, the "Lapline" can carry up to 100,000 barrels of crude oil daily to the loading terminal which has been enlarged to deal with the increased intake made possible by the pipe line. Much of this is processed at Shell's Cardon plant on the Paraguana Peninsula, where the largest refinery in South America is located.

The deck of the laying barge during operations. The submarine line was completed in 77 days, a normal day's lay being 1,500 feet of pipe.

The tie-in weld is made and the welded section is moved to other work bays on the barge for filling in, X-ray checking and final protective covering of joint ends.



New Research Laboratory Dedicated by UNIVERSAL OIL PRODUCTS

A MULTI-MILLION dollar research laboratory was dedicated by Universal Oil Products at Des Plaines, Illinois, on October 28. The three-story brick building incorporates ideas which the company has been accumulating in five years of visiting and evaluating laboratories of similar purpose around the world. The result is an impressive example of modern design for maximum efficiency and safety.

As part of its dedication ceremony, UOP invited over 100 guests from all over the U.S. to attend a breakfast, followed by lunch at the Tam O'Shanter Club on the outskirts of Chicago and then by a tour of the laboratory itself and finally by a dinner at which Mr. David W. Harris, president of UOP, introduced the principal speaker, General Thomas D. White, Vice Chief of Staff of the U.S. Air Force.

Universal's new research laboratory building which houses the most modern devices available for research in the petroleum field.

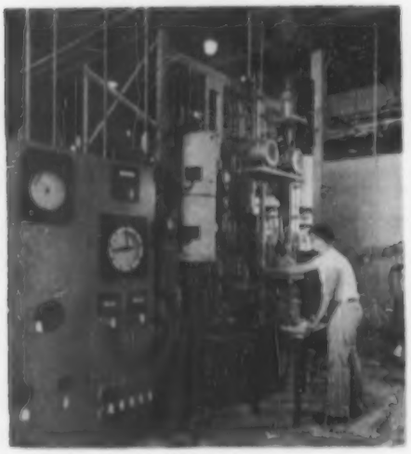
The talk by General White demonstrated the intense interest the Air Force has in research into fuels for defense. The Air Force buys about three quarters of a billion dollars worth of fuel every year, a sizable market "even for the petroleum industry," as General White remarked. Much of this is accounted for by the tremendous consumption of fuel in jet aircraft, he stated, which totaled over 65 million barrels of jet fuel in 1955, but a large share remains in gasolines, which amounted to 30 million barrels for high octane and 15 million barrels of lower octane.

General White went on to say that the total of fuel used by the Air Force runs around 120,000 b/d. The amount of aviation gasoline of 100 octane or less is going down steadily while jet fuel is rising at about 20 percent yearly. The demand for aviation gasoline of high octane, however, continues to rise and the General estimated that procurement of same would continue at high rate for the next several years and that the bulk of transports and tankers would continue to be piston powered and thus users of aviation gasoline for a long time.

Refinements of Air Force demand were brought out by General White's speech. The prevailing search for a "hotter" jet fuel, one giving more Btu's per pound of fuel, continues, since the discovery of such a fuel would give added speed and range to Air Force planes. In addition he outlined the probable future course of nuclear power in aircraft. It will be a long time, in his estimation, before a large enough fleet of bombers is in operation to noticeably reduce fuel requirements. When this occurs the actual result may be to employ nuclear powered aircraft as tankers, since a tanker which did not consume any of its fuel load would be able to extend the range of jet bombers or fighters by meeting them far out from bases. This development would greatly reduce Air Force dependence on foreign bases by, in effect, substituting fuel for such foreign bases. It would, in any case, greatly extend the flexibility of attack routes, refueling points, bomb loads and routes of withdrawal.

Laboratory Design: Some of the features of the new laboratory include placing of all laboratory rooms on the same side of the building, thus incorporating all fixtures in the same area and giving the best possible light, while offices are on the opposite side directly across the hall. All housing pipes and lines for water, gas, hydrogen, electric and other services are in enclosed shafts which open on the hall and have shut off valves for control of flow to each laboratory in case of emergencies. The windows are sealed, since the entire building

The entrance lobby of the new laboratory has a large mural made from a photograph of the Old Chicago Water Tower, taken by Universal's president, David W. Harris.



One of the features of the semi-works wing, projecting north from the main building is a Platforming process bench scale unit, a working miniature of equipment used in a modern refinery.

is air conditioned, with circulation being toward the laboratories to avoid any fumes being transported out into the halls. All laboratories which operate on a continuous basis are grouped together in a semi-works wing projecting north from the main building. It houses miniatures of major processing units for experimentation such as the Platforming unit shown in the accompanying picture.

The main building is 312 feet long, 50 feet high with a penthouse accommodating air conditioning facilities (except main pumps) running the full length of the structure. There are 31 separate laboratory units and 39 offices, conference, balance, instrument and computing rooms, and other facilities. There is a photo laboratory on the second floor, and a glass blowing shop, chemical storage, storage vaults, a mechanical equipment room and a technical library with stack space for more than 10,000 volumes on the first floor.

Beneath the lobby, which is paneled with travertine stone, is one of the laboratory's most interesting features—a bomb shelter 37 feet wide and 80 feet long that will normally function as an auditorium-type meeting room for up to 225 persons but can, through the use of folding panels, be divided into a series of conference rooms. The entire space, covered by a massive reinforced concrete slab, has independent ventilation and power generating units, a first aid room and a storage cubical for emergency food rations.

Projecting north from the main building 170 feet is a semi-works wing, 61 feet wide, housing laboratory activities operating under supervision on a 24-hour basis. Included in this area are two sample rooms, one constantly maintained at 35 degrees temperature and the other at 100 degrees.

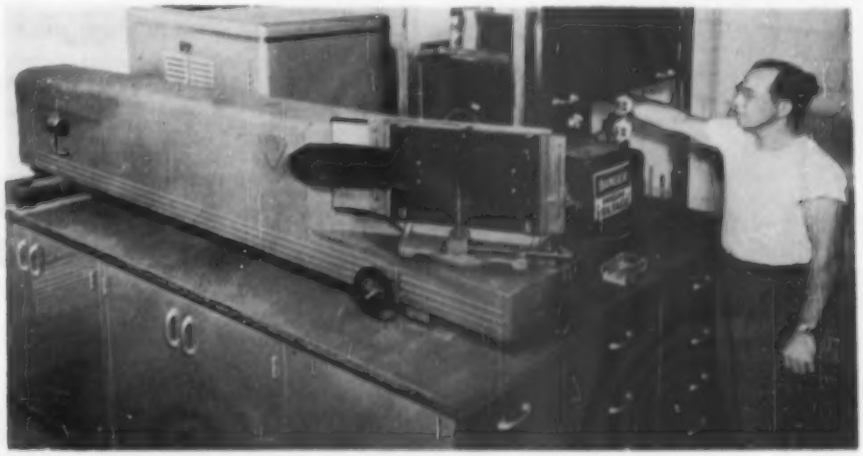
The administrative headquarters, also three stories high, is connected by a 200-foot tunnel and was occupied in October, 1952. Ground was broken for the new structure in April, 1954, by Sherman Olson, of Chicago, the general contractor.

Five systems provide air conditioning, with one serving the bombproof meeting room area and others uniting to take care of the remainder of the building. Supply units in the penthouse force fresh air through diffusers in the ceiling of rooms on the south side of the building, and it is exhausted through fume hoods in laboratories on the north side. The fume hoods are controlled by 20 exhaust fans in the penthouse. Heat for the entire building is provided by two 250 hp low pressure boilers.

North of the main building is a 270 by 300 foot storm water impounding reservoir with a capacity of more than three million gallons of water. Water from the parking lots and building roofs enters the reservoir through a 36-inch pipe and enters the village of Des Plaines storm drainage system through a valved 12-inch outlet.

Glassblowers at the new research and development laboratory fabricates special glass apparatus used in research. A lathe for fabricating complicated glassware is shown in operation.

Quartz emission spectroscope used in the new laboratory for analyzing catalysts. Various kinds of trace metal contaminants may be thus determined before they accumulate and degrade catalyst quality.



ON A SUNNY MORNING in 1952 nine men walk to work. They are Australians walking into the biggest thing their country has seen for years, a 3-year epic that will change a desolate area of scrub and sand into the Continent's largest, most important oil refinery:- Kwinana!

Kwinana, on the shores of Cockburn Sound, 12 miles from Fremantle, was completed months ahead of schedule! Now, this £A40,000,000 project can handle 3 million tons of Middle East crude a year, possesses its own oil port, and a jetty which is large enough to take three tankers at a time.

Here is the familiar 20th Century skyline: slim, steel towers, bulbous spherical storage tanks, the huge tower of the catalytic cracking plant dominating a landscape where miles of piping stretch across the sand.

And for the men who work at Kwinana there is a township to settle in, to bring up their families in. History is being made, a future is being born.

Behind the achievement is the Kwinana Construction Group (Pty.) Ltd. This consortium of three British companies was formed to build the entire plant for Australasian Petroleum Company (an associate of the British Petroleum Co. Ltd.) to the designs of the M. W. Kellogg Co. and the Kellogg International Corporation. So successful has this consortium been that the association will continue to build and to design similar installations throughout the world.

A Key to Australia's tomorrow

The Kwinana Construction Group(Pty) Ltd.

LONDON OFFICE: 54 VICTORIA STREET, LONDON, S.W.1 *TATe Gallery 0683*
CANADIAN OFFICE: ROSS-MEAGHER LTD., 9 ECHO DRIVE, OTTAWA 1, ONTARIO

EA 5447

The British Petroleum Company's new Kwinana refinery near Fremantle, Western Australia was officially opened on 25th October, 1955 by Field Marshal Sir William Slim, Governor-General of Australia, shown speaking at the opening ceremony.

KWINANA—

Australia's largest refinery officially opened

THE three million ton, about 60,000 b/d, refinery built by British Petroleum Co. Ltd. at Kwinana, near Freemantle, Western Australia was officially opened by Field Marshal Sir William Slim, Governor-General of Australia, on Oct. 25, 1955, in the presence of a distinguished company including Lord Strathalmond, chairman of British Petroleum Co. Ltd., the Hon. A. R. G. Hawke, Premier of Western Australia, with members of his Cabinet, and Sir Ross McLarty, the Leader of the Opposition. Members of the Australian Federation Government present were Senator Neil O'Sullivan, Minister for Trade and Customs, P. M. C. Hasluck, Minister for Territories. About 6,000 people were present at the opening ceremony consisting of about 1,000 guests and 5,000 employees and families.

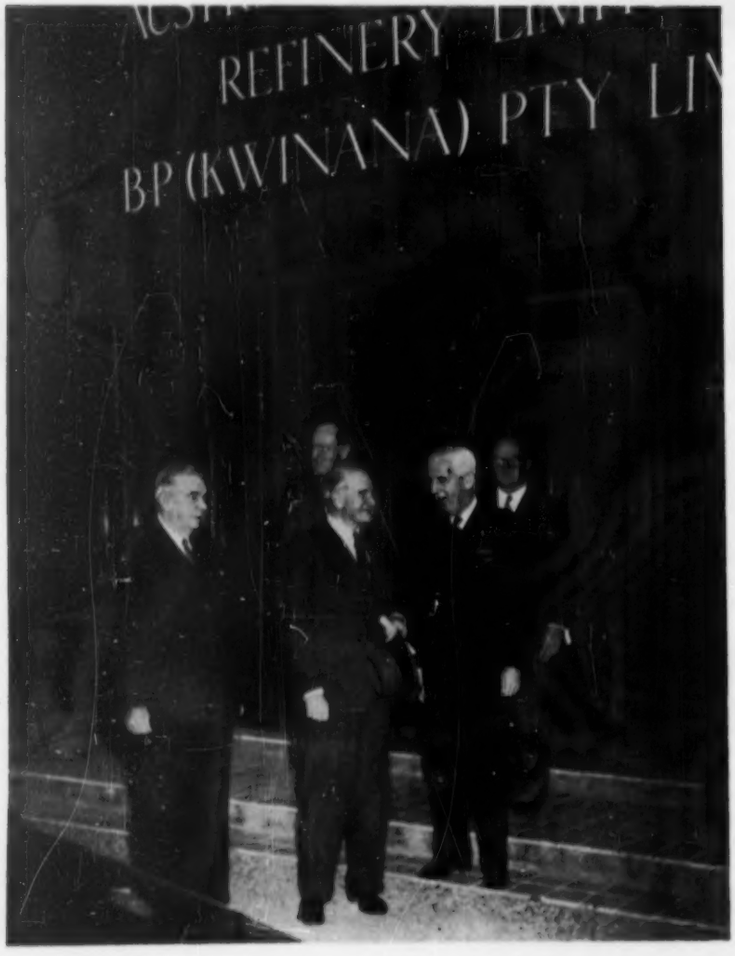
Kwinana is the largest petroleum refinery in Australia and has been on stream since February 1st this year. It was built at a cost of £30 million, or about $85.5 million which compares favorably with the cost of building a refinery of this capacity in other parts of the world.

The operating company for the refinery is Australasian Petroleum Refinery Ltd., an Australian associate of British Petroleum. The products of the refinery are mainly fuels, i.e., gasoline, kerosine, diesel and fuel oils and bitumen for the markets of Australia and New Zealand. No lubricants at present being manufactured.

The main contractors for the refinery design and engineering were the M. W. Kellogg Co. and its British registered subsidiary, Kellogg International Corp., who in cooperation with Kwinana Construction Group (PTY) Ltd., a consortium of British contractors consisting of Costain-John Brown, D. & C. & Wm. Press Ltd. and Kinnear Moodie carried out the building of the refinery and tanker jetty construction.

The British Petroleum Company's new 3,000,000 tons a year Kwinana Oil Refinery near Fremantle, Western Australia, was officially opened on October 25, 1955, by Field Marshal Sir William Slim, Governor-General of Australia. Photograph shows guests arriving for the opening ceremony, from left to right: Mrs. A. R. G. Hawke; Warren Smith, President, M. M. Kellogg Co.; Senator Dorothy Tangney, representing Federal Opposition; Mrs. D. W. Brisbane, wife of A.P.R.L. Chairman; Lord Strathalmond, Chairman of BP Company; Lady Strathalmond; Mr. A. R. G. Hawke, Premier of Western Australia.

His Excellency The Governor General of Australia, Field-Marshal Sir William Slim, being met on the steps of the main entrance to the Administration Building of the Kwinana Refinery. To his left is Mr. D. W. Brisbane, Chairman of Australasian Petroleum and B. P. (Kwinana) Proprietory Limited. To his right is His Excellency, Lord Strathalmond, C.B.E., LL.D., Chairman of The British Petroleum Company Limited, London.



This tanker jetty is situated on Cockburn Sound, which with an area of about 17,000 acres is practically landlocked, thus forming a safe harborage for tankers at all states of weather. To attain access to the harbor for large tankers, channels had to be dredged through the Success and Parmelia sandbanks, giving a channel about 4½ miles long, 500 yards wide and 38 feet deep at low water.

Western Australia State Government were responsible for the harbor preparations, and dredging was done by two Dutch dredgers of Hollandse Anneming Maatschappij, Capetown, S. Africa. The refinery was originally scheduled to go on stream in April 1955, but since completion date was anticipated by 100 days it actually went on stream on Feb. 1, 1955.

The representative of the oil company, C. H. E. Rebbeck, arrived at the site in October 1952 to take charge of the building on the company's behalf, and was joined shortly after by the Kellogg representative and the Kwinana Construction group's representative. The first sub-contracts were let in November 1952 and actual work on these started in January 1953, leaving an actual building time of 25 months.

Behind these facts is a story of intense planning and cooperation between govern-

British Petroleum Company's new Kwinana refinery was officially opened on 25th October, 1955 by Field Marshal Sir William Slim, Governor-General of Australia. Photograph shows; from left to right: D. W. Brisbane, Chairman A.P.R.L.; A. E. Mason, Managing Director, A.P.R.L.; Lord Strathalmond, Chairman BP Company; and D. W. K. Barker, Refinery Manager, A.P.R.L.

ment departments, shipping and transport companies, erection engineers, civil engineers, labor management, etc. In the beginning it was estimated that a total labor force of 2,000 to 3,000 tradesmen would have to be imported from the United Kingdom, but owing to the good response of local labor and employment of European immigrants, now known as New Australians, this estimate had to be drastically revised, in fact the major portion of the labor employed on the job, including skilled labor, was recruited at the gate, and only about 100 out of a total of about 2,000 craftsmen were brought in under contract.

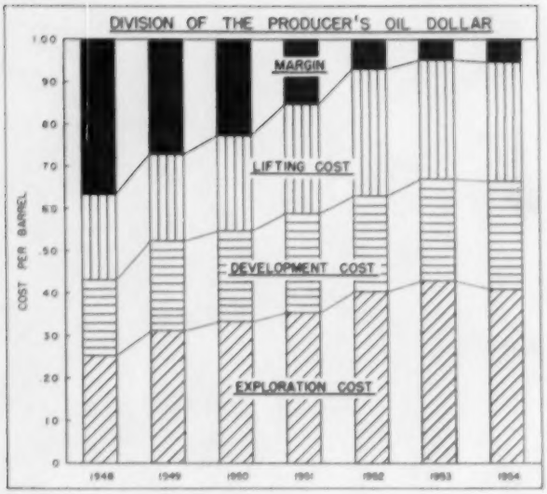
This condition considerably reduced the size of the camp required to house labor, the maximum number requiring housing at any one time being 400, and this tended to ease the erection problem, but in its turn posed another problem, i.e., the transport of workers to site, which the ordinary local facilities could not cope with. This difficulty was solved by the operation of a special fleet of over 40 buses running between Perth, Freemantle and the refinery site. At the peak of building operations almost 3,500 men were employed on the site.

What had probably the greatest influence in cutting down the building time of this refinery is the fact that British manufacturers, who supplied nearly 60 percent of the refinery's requirements, gave good delivery dates and adhered to them strictly. When the refinery plan was initiated in 1952, steel supply in the United Kingdom was very critical and manufacturers supplies were based on priorities which were regulated by the iron and steel distribution scheme. This situation called for allocations to the manufacturers and then the careful budgeting of these allocations so that there should be no interruption of flow of new material to the manufacturer, who on this basis could program his work in the shops.

The manufacturer having completed his portion of the plant on time, it then remained to arrange shipping for the long voyage of 11,000 miles, so that the fabricated article could be received on site, to take its proper turn in the erection program. Great credit is due to the planning team of the Kellogg group, for their handling of this part of the program, and also to the fabricators of the various equipment for adhering closely to delivery dates and in fact in some cases anticipating them, as without this prompt delivery the planning schemes could not have been carried out.

In his speech at the official opening ceremony, Sir William Slim said that the building of this refinery by the British Petroleum Co. was accepted as the most important single economic impact on Western Australia in the State's history. It was described as an enterprise in which not only the company but all Australia can take pride. They looked for a sound stable government and progressive people to give confidence in the future without which no great enterprise could flourish and expand.

The Western Australian Premier, Albert Hawke, said Kwinana refinery would help the State to grow much more quickly than would be possible under other conditions, and would serve as a magnet to other important secondary interests. He extended a special welcome to Lord Strathalmond as he, after all, had the final responsibility for the selection of Kwinana as a site for this refinery. Lord Strathalmond pointed out that when the 100,000 tons Laverton refinery of Commonwealth Oil Refineries was commissioned in 1944, Australia's consumption of petroleum products was about 200,000 tons per year, but in the interim this consumption had risen to about six million tons per year, a thirty-fold increase, and this new refinery had about the same relation to Australia's present consumption. This consumption is bound to increase with transport and so many other consumers so dependent on it, and the petroleum industry considered it had the unique duty of supplying all demands of quantity and quality imposed on it.



RISING COSTS JUSTIFY HIGHER CRUDE PRICES

By H. J. Struth

The relationship between costs and crude prices is but one of many studies found in the new, 1955 annual volume of World Petroleum Report, of which Mr. Struth is the Editor. Completely revised and improved, the new volume contains nearly 500 pages of useful facts, figures and operating data. The cross-index contains 6,000 references to information on every phase of the industry's international operations.

Oil producers, like operators of other basic industries, have experienced diminishing returns from their operations due to constantly rising costs. While prices of many other basic commodities have advanced under the impetus of higher costs, oil producers have not generally shared in such commensurate rewards.

Every phase of the business of finding, developing and producing crude oil has been accompanied by rising costs, the combination of which has resulted in successively smaller combined cost of exploration, development, and production of crude oil has increased 48.4 percent, while the price of crude oil has been advanced only 6.5 percent.

Today's margin per crude oil dollar is only 5.6 cents, whereas in 1948, the producer's margin was 36.4 cents per dollar. The combined cost of exploration, development and lifting crude oil today averages $2.24, against an average price of crude after royalty payment of $2.37. The margin, before overhead charges is now only 13 cents per barrel, compared with the 1948 margin of 81 cents per barrel.

In relationship with the gross production of crude oil, today's cost of exploration is 97 cents per barrel, against 56 cents in 1948. This marks an increase in exploration cost of 73 percent. Development cost today averages 60 cents per barrel, against 40 cents in 1948, an increase of 50 percent. Lifting costs now average about 67 cents per barrel, against 45 cents in 1948, an increase of 50 percent.

In the face of these rising costs, it is obvious that there is a definite need for a substantial upward revision in crude oil prices. The average price of crude at wells is now $2.82 (net to producer $2.37), compared with an average price in 1948 of $2.60 (net to producer $2.22). Thus, while the net price to the producer has advanced only 15 cents per barrel since 1948, his costs of finding, developing and lifting oil have increased 83 cents per barrel.

Even if we assume that the average margin to producers during the three-year period 1948-50, amounting to 66 cents per barrel, is an adequate return before overhead charges, the average price of crude oil today should be in the neighborhood of $3.55 per barrel. In other words, a 75-cent advance would certainly not be unreasonable, and would undoubtedly intensify the search for new sources of future oil supply.

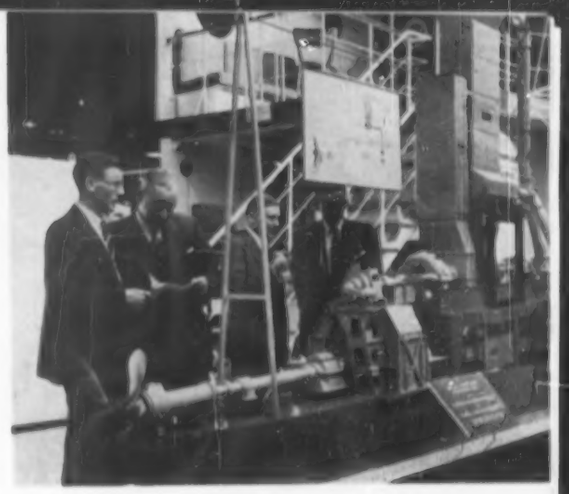
Reserves discoveries are not keeping pace with immediate and future oil requirements, and a "shot in the arm" in the form of a 75-cent advance in crude prices would go a long way to provide the incentive needed to spur the investment of risk capital in the expansion of the nation's reserves of oil.

DIVISION OF CRUDE OIL COSTS AND MARGINS
(U. S. Averages)

Year	Price to Producer (a)	Exploration Cost	Development Cost	Lifting Cost	Total Cost	Producers' Margin (*)
			Per Gross Barrel Produced			
1948	$2.22	.56	.40	.45	$1.41	$ .81
1949	2.27	.68	.45	.45	1.58	.69
1950	2.16	.73	.45	.50	1.68	.48
1951	1.96	.77	.50	.55	1.82	.14
1952	2.16	.87	.50	.65	2.02	.14
1953	2.29	.99	.55	.65	2.19	.10
1954	2.37	.97	.60	.67	2.24	.13
			Per Net Oil Dollar			
1948	$1.00	.253	.180	.203	.636	.364
1949	1.00	.314	.207	.207	.728	.272
1950	1.00	.337	.208	.231	.776	.224
1951	1.00	.358	.231	.254	.843	.157
1952	1.00	.402	.231	.301	.934	.066
1953	1.00	.430	.240	.283	.953	.047
1954	1.00	.409	.253	.282	.944	.056

(a) After royalty Payment (*) Before overhead charges

Source—Compilations by H. J. Struth, Editor, WORLD PETROLEUM REPORT



A model of a single 5,500 hp gas turbine unit, designed and laid out by British Thomson-Houston Co. and Cammell Laird & Co. This unit will shortly replace the existing power unit of 1,200 hp gas turbine and three diesel alternators aboard the 12,250-ton (dw) Shell tanker "Auris."

BRITISH EQUIPMENT SHOW

THE EQUIPMENT show was held at Olympia, London, from Sept. 1-15 under the presidency of H. S. "Dick" Broom. The quality of the exhibits was high, but it would appear, however, that there are few new products on view, which probably can be explained by the fact that manufacturers as a whole have full order books on the one hand and a scarcity of technical personnel for development work on the other, so new development has to a certain extent given way to intensive production.

There have, however, been some developments during the past two years since the last exhibition of interest to the petroleum industry. Among the new equipment is a portable Burton pressure butt welding machine of novel design for the welding of steel pipe exhibited by the Royal Navy. In this system, the weld is effected in the solid phase of the material by a heat-pressure sequence and is produced automatically by allowing the material change during heating to control its own welding cycle.

A low hydraulic pressure is applied to bring the prepared faces of the pipe together. A control rod, carrying contacts actuating electrical limit switches, is then locked to the moving part and by recording linear dimensional changes causes the sequence of operations to occur. Heat is then applied to the interface by an oxyacetylene multiple-jet burner, which oscillates circumferentially, and is also maintained on the joint line by a mechanical half travel device. When a present expansion is reached a second higher hydraulic pressure is applied which overcomes the thermal expansion pressure and gradually returns the pipe to its original cold length.

The final high pressure, which forms the weld, is then applied and the upsetting continues until arrested by the present travel allowance switch which shuts off gas supply to the burner and then unloads the hydraulic pressure.

New Treatment for Plug Valves: The Audley Engineering Co. Ltd., Newport, Shropshire, has developed a new treatment for valve plugs which they call the "Lubecoat Process," which has stood up under exhaustive field tests. This process produces a change in the nature of the surface of a metal giving it the properties of a low coefficient of friction, the property of absorbing and retaining a lubricant, and in the case of iron and steel, it protects the parent metal from atmospheric rusting.

Although the lubecoated plug appears to have a matt surface, compared with a highly polished surface of an untreated plug, yet its coefficient of friction is less and this porous surface has the property of absorbing and retaining the lubricant, which is not washed out by highly penetrating petroleum solvents and synthetic hydraulic oils which usually cause increased lubricant consumption in valves, especially those operated frequently. This new type plug is in production and is applied to plugs at no extra cost.

New Direct-Drive Gas Turbine for Shell Tankers, Ltd.: The British Thomson-Houston Co. (Rugby) had on view a scale model of the single 5,500 hp gas turbine unit, which is to replace a 1,200 hp gas turbine and three diesel alternators aboard the 12,250 dwt Shell tanker "Avris." The design and lay-out of the new installation is the work of British Thomson-Houston Co. and Cammell Laird & Co. of Birkenhead acting in close collaboration with Shell's Marine Research and Development Department.

Flexible Couplings: Crofts (Engineers) Ltd., Bradford 3, England, exhibited two new flexible couplings which should be of interest to the oil industry, particularly in undeveloped countries where power units for drilling, pumping, etc., have to be installed under unfavorable conditions or by the use of semi-skilled labor. The "Uniflex" coupling is an all-metal one, and is designed to deal with angular or lateral misalignment or a combination of both, and also permits axial float of the shafts and prevents end thrust being transmitted from the driving to the driven unit. No lubrication is required for it.

The predominant feature of the "block-type" coupling is the degree of resilience obtained through the large volume of special oil-resisting rubber incorporated in the design which can accommodate angular or lateral misalignment. Freedom from backlash is assured as the rubber blocks are precompressed in the transmission unit and cannot unlead in either direction of rotation.

Packaged Diesel Engine for Oil Field Duty: The English Electric Co., Ltd., London W.C.2, has produced a new 8V/8SV packaged diesel unit to cater to the higher power requirements called for in modern deep drilling by the use of a medium speed conservatively rated engine. Good torque characteristics together with an infinitely variable speed range ensure that varied conditions met with during drilling operations can be met. The unit can also be used for other requirements in oil field work such as power generation, pumping and compressor drives.

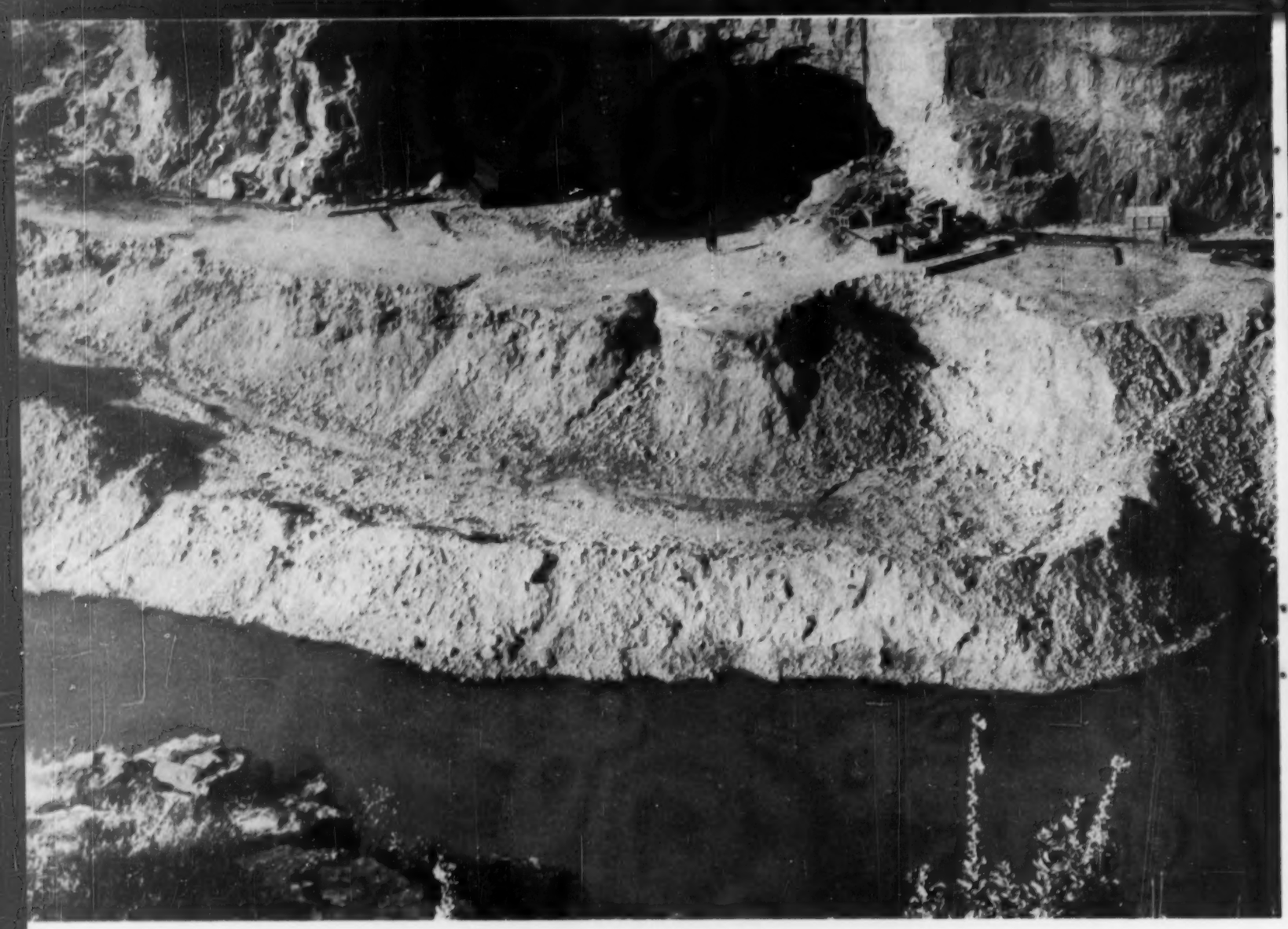
This medium speed engine can be naturally aspirated or pressure charged, is 4-stroke cycle, with 8 cylinders (10-inch bore by 12-inch stroke) arranged in two banks in "VVE" formation at an included angle of 45°. Speed range of 400 rpm to 850 rpm under control of a variable speed governor. Horsepower for the 8V naturally aspirated, 12 hours rated at 850 rpm was 647 bhp, for the 8SV turbo-pressure charged 12 hours rated at 850 rpm it was 1,066 bhp.

Complete Cooper-Bessemer Compressor Built in the U.K.: Messrs. Harland & Wolff, Ltd., Belfast, are the licensees in the U.K. for the manufacture of the well-known Cooper-Bessemer compressor of America and have assembled many of this type of compressor using parts fabricated in the U.S.A. The first of this type of compressor completely fabricated by Harland & Wolff at their Belfast works was on view at the exhibition. It is a Type FM-4 horizontal compressor, and is one of three similar units ordered by Procon (Gt. Britain), Ltd., from Harland & Wolff, on behalf of "Shell" Refining and Marketing Co. for installation in a Platforming unit at their Shellhaven refinery. When installed at Shellhaven this compressor will be driven by a steam turbine, through gearing.

Voith Schneider Cycloidal Propeller: R. A. Lister (Marine Sales) Ltd. of the Lister-Blackstone group had on exhibit a Voith Schneider cycloidal propeller which is powered by a Lister-Blackstone E.V.M.C. 6 diesel engine, one of an order for nine such units to be installed in the new fleet of estuarial tankers now being built for Shell-Mex and B.P. Ltd.

Naval Gas Turbines: As the result of successful operation at sea of a gas turbine rated at 2,500 shp designed and manufactured by Metropolitan-Vickers, Trafford Park, Manchester, larger G2 units have been designed by the same company for naval

(*Continued on page 67*)



The impact of oil on the economy of

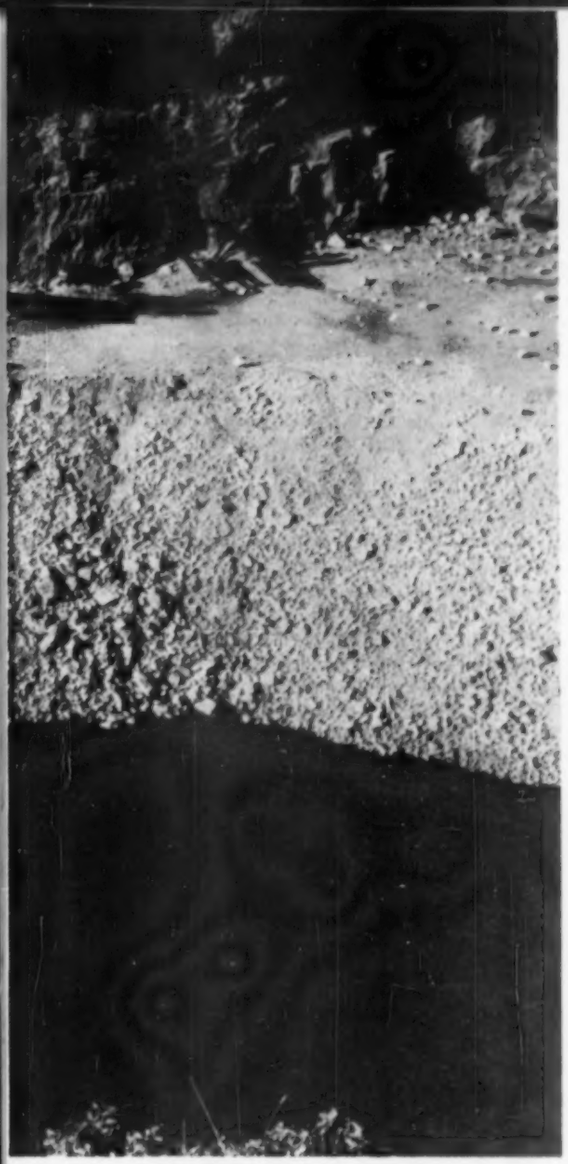
SINCE the end of the second world war Iraq, along with other Middle East countries, has received an increasingly large income from the results of oil production within its borders, and the expenditure of this large income has exercised a growing influence on its people.

Iraq has a geographical advantage over the other Middle East countries in that a considerable river system runs through it, which in the past ages by the use of irrigation made Iraq the most fertile of Middle Eastern countries but which in recent years has fallen into decay, with the result that millions of acres until recently were practically little better than desert land, from an agricultural standpoint. The rehabilitation of these desert lands with their large potential fertility was therefore an obvious target, in the attainment of which large amounts of revenues received from petroleum exploitation could be usefully employed, which could be given a high priority and which would be of great ultimate benefit to the country.

Though at the time of the advent of oil the machinery of government in Iraq was not highly developed, according to western world standards, yet the basis was there to provide a control over spending of these oil revenues. A Development Board was established in Iraq in 1950 which includes among its members two foreign experts. At first the whole of the proceeds from oil development was allocated to this board, but later when the 1952 agreement came into being, 30 percent of the receipts was allocated to ordinary government revenue and the remaining 70 percent to the activities of the Development Board. The principal objects of expenditure of the Board are flood control and irrigation works which take approximately 35.5 percent, the erection of buildings, which takes about 20.0 percent, roads and bridges, about 18.0 percent, industry, mining and electricity about 14.5 percent, railways about five percent, agriculture and animal husbandry about two percent, imports about 1.5 percent and miscellaneous about 3.5 percent.

In the beginning material progress on these schemes was slow, as the primary studies and planning, which are essential in such projects, show nothing which is visible to the general public. There have been occasions when a considerable amount of irritations arose due to lack of visible signs of progress, influenced to an extent by political agitation.

One of the major projects which the Development Board is carrying out is the building of the Dokan Dam to harness the



The mouth of the diversionary tunnel bored through the left bank of the Dokan Gorge through which the waters of the Lesser Zab river will be diverted while the Dokan Dam is being constructed.

(All photos used in this article are Iraq Petroleum Co. Ltd. photos)

House built for the staff of the resident engineer at Dokan. More than 1,300 are employed on the task of preparing groundwork for the construction of the Dokan Dam, of whom 200 are foreign technicians.

At the bend of the Lesser Zab river the Dokan Dam will be built layer by layer across the gorge to a height of 350 feet. A 104 square mile artificial lake will be built behind the dam with a capacity of 1½ million gallons of water, more than double the capacity of Lake Habbiniyah, which will be used for farm land.

IRAQ

The diversionary tunnel, which is more than 1,200 feet long and 40 feet in diameter, provides sufficient headroom for two double-decker buses to pass through, one on top of the other.

waters of the Lesser Zab river and eventually to provide irrigation and hydro-electric power. The site of this dam is about 40 miles northwest of Sulaimaniyah in a narrow gorge dominated by rocky hills and mountains. When completed it will cause a new lake, of over 100 square miles, to be formed by the waters of the Zab.

Work on the project started in March 1954. The first part of this consisted of making preparations to divert the waters of the Zab before construction of the dam itself could begin. The main portion of this work, which is now almost complete, was the boring of a diversion tunnel 1,200 feet long and 40 feet in diameter inside the concrete lining. The rock through which this tunnel was driven was sound dolomite, which was relatively easy to drill and required little support. In addition a cofferdam is to be built, by which the waters of the Zab will be diverted from the site of the dam, and thus allow building to be carried on without interruption.

It is expected that the actual building of the dam will start early next year. When the dam is completed, the cofferdam will be removed, and then the waters of the River Zab will be contained behind the dam, ready for useful employment.

Subsidiary to the dam, will be the building of works to control the distribution of the collected waters for irrigation purposes. This consists of the construction of barrages and an extensive system of irrigation channels. A barrage is scheduled to be built at Batmah on the Lesser Zab, about 90 miles downstream from Dokan, and another at Dasnir Kapu, on the Adhimain river, followed by channels over a wide area in the Erbil, Kirkuk and Diyala Liwas to provide irrigation over about 2,000

square miles of land which at present are not commercially profitable from an agricultural standpoint.

In addition, it is proposed to install a hydro-electric generating station at the dam, which will have a potential capacity of 143,000 kw, the dam itself being equipped with five steel-lined intakes, each 12 feet in diameter through which water under high pressure will be used to drive the power house turbines. The dam itself will be built up some 385 feet high with a cross section of 175 feet at the base and 30 feet at the crest. To prevent water escape below the dam, the porous lime stone beneath the footings will be injected to a depth of about 100 feet with cement mortar.

The estimated cost of the dam is £11 million and the total estimated cost of the whole project is £23 million. The main contractors for the dam are the Group Dumez-Ballot of Paris and the consulting engineers are Binnie, Deacon and Gourlay of London. The completion of this dam will provide cheap hydro-electric power, for which a certain percentage of petroleum income is to be used as part of the Development Board's program.

Second only in importance to the above projects is the development of communications in the form of roads and railways. In the past, it has been a major operation for the inhabitants of northern Iraq to establish personal contact with those of the south, at Iraq's seaport of Basrah for example, owing to the lack of direct links by road or rail. Iraq has all the materials within its own borders for the building of roads and the Development Board has made this a major project.

With this end in view, a start has been made in the erection for the government of the Qaiyarah refinery which has been built with the main object of producing asphalt for these roads from the heavy bituminous oil wells in Mosul. This modern asphalt refinery is scheduled to produce annually 36,000 tons of 60-80 penetration asphalt, 9,000 tons of 180-200 penetration asphalt and 15,000 tons of asphalt for the preparation of cut backs.

A new road connecting Baghdad with Kirkuk is to be built. The contract for this of £2.8 million has been awarded to the French firm Enterprise Tougerolle. Other main roads are in process of building, including new access roads between Kirkuk and Sulaimaniyal and the new Dokan Dam.

Another of the major steps taken by the Iraq government in its program of development and industrialization of the country was the erection of a refinery at Dourah, a few miles from Baghdad, with a crude daily throughput capacity of 24,000 barrels. The first section of this refinery was built for the production of gasoline, kerosine, and light and heavy fuel oils, but a further section for the manufacture of high grade lube oils is being added. The distribution organization for these petroleum products is government-controlled and is being extended to cover the whole of Iraq's domestic interior petroleum markets.

In addition to Iraq's direct activities in the oil industry projects are on foot for the development of other natural resources and for the creation of new industries. Plant construction is planned for the manufacture of cement, fertilizers and heavy chemicals and other materials. At the present time, a textile factory is being built at Mosul for the spinning and weaving of cotton at a cost of £2 million. This factory is to have 25,000 spindles and about 650 automatic looms, together with the necessary preparation plants such as winding, warping and sizing machines. It is assumed that the raw cotton for this mill will be that grown in Iraq, the production of which will be increased when the new irrigation system is in operation.

Other manufactures which are being fostered and encouraged are those of brick and tile making, ice plants, cold stores, mineral water works, furniture works and laundries. A local firm has started to manufacture steel windows and furniture, and the oil companies are taking advantage of this to satisfy some of their requirements in that direction.

The Development Board has also large projects in connection with various municipal authorities for the erection of modern buildings, improvements to streets and roads, installation of modern sewage systems, building of hospitals and health centers, etc. A medical center is projected for Baghdad which will include a large modern hospital, and a medical college which will deal with dentistry, opthalmogy, pharmacology, etc., the cost of which is estimated to be about £3 million. A general expansion of state medical services is also projected.

Technical education is also being widely extended, with a view to making Iraq self-sufficient in scientists, technicians and skilled artisans. At present the country has to rely to a great extent on imported personnel for these services.

In the past the oil companies have carried out their own education schemes at their own training centers, primarily to satisfy their own requirements, and with the hope that on completion of their training, these skilled operatives will remain in the service of the companies; these hopes have, however, not always been fulfilled and many of the skilled men have eventually been absorbed in government service or joined national companies.

Many of the Middle East peoples seem to prefer working for their own companies, even though to western minds the conditions of employment under the foreigner appear to be more favorable. That, however, can be understood on many grounds, such as language, compatability of ideas, religion, etc. The drift will probably continue, therefore, and from an overall standpoint may be to the benefit of the country and all concerned.

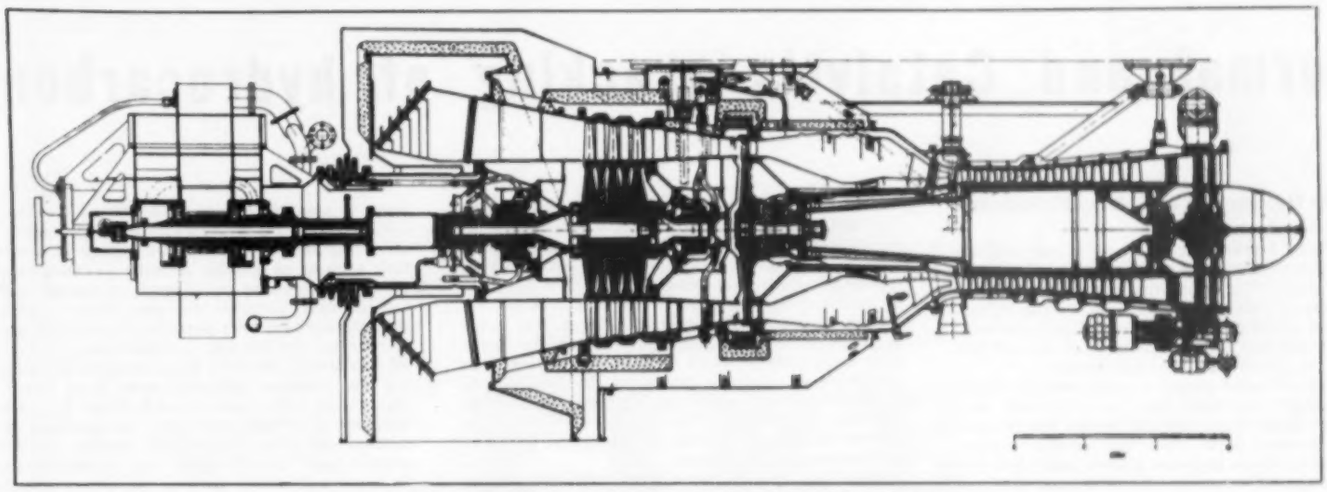
While the oil companies continue to provide and extend these educational facilities for their employees, Iraq realizes that education in general is essential to raising the living standards of any country, and therefore is devoting considerable sums out of its oil income for the development of education. This is a long term policy which cannot be undully hastened, but given intelligent control and freedom from political influence it will pay dividends and help render the country self-supporting in technical achievement, whereas at the present many local schemes are held up temporarily for lack of trained staff to carry them out and for which it is not feasible to employ expatriates.

Housing is another problem which is engaging the attention of the Development Board Compared with some of the Middle East countries, housing in Iraq is of better quality generally, but according to western ideas is of a low standard. Whether western ideas in this direction are a good target at which to aim is a moot point, dependent on the climate, customs, religion etc., but one thing is certain and that is it is of little use providing the latest in medical services and preventive medicine if the population is to be housed under unsanitary conditions.

The housing problem has been with the oil companies since the inception of their operations as these have in the main been carried out in sparsely or totally uninhabited regions, and so housing and shelter for all personnel has been necessary. Until oil was struck and the territory developed, this housing was of temporary nature, but later permanent dwellings were built for all classes of employees, except possibly at the Zubair field which has the advantage of being close to Basrah from where local staff could be drawn.

The oil companies in Iraq considered owner/occupier to be a good policy and have fostered this idea, with the result that many of its employees live in houses which will eventually become their own property. The company provides the building plots, the employee chooses the design of the house he would like, the company places the contract for building and supervises the erection and the employee meets the cost with a loan at low rate of interest which he repays out of savings and wages. In Iraq the scheme is not tied to the job, and the contract does not lapse if the employee changes his job, so long as he keeps up payments. It is quite possible that the Iraq government will develop some such scheme with regard to its housing problem.

Generally speaking, Iraq is employing its petroleum income in an enlightened and progressive manner and good results should soon be shown. The Government might, however, with advantage have been more communicative regarding the projects it has embarked upon, and kept the general population better informed. Large projects like these require a large amount of planning and preparation and while in the beginning a lot of work has to be done which does not immediately show, yet it would be good policy to advertise this in some way and thus reduce criticism based to a great extent on lack of up-to-date knowledge.



The Metropolitan-Vickers G-2 Naval Gas turbine rated at 2,500 shp.

British Equipment Show

(Continued from page 63)

use. The G2 gas generator (compressor combustion chamber, compressor turbine and auxiliaries) is, with certain modifications, that of the Beryl jet engine.

This gas turbine is only used at high speeds and is designed for a total life of 1,000 hours of which 300 may be run at maximum power. Diesel engines provide the power for cruising and maneuvering.

The power/weight ratio (complete unit) is 2.16 lbs/shp. The fuel for the unit is ordinary pool gas oil.

Oil-Flooded Rotary Air Compressor: A light weight, oil-flooded rotary air compressor built by the Consolidated Pneumatic Tool Co. of London and powered by a F. Perkins Ltd. L4-four-cycle diesel engine is shown, and is the first oil-flooded portable rotary compressor to be manufactured in the U.K. The 120-RO-2 rotary compressor has a full 100 cubic feet delivery at 100 psi and a complete range is in production. This "Power Vane" compressor is a two-stage unit designed to run in oil, with oil cooling and oil sealed clearances.

Separation of oil and air is so efficient that there is less carryover of oil than in the piston type machines. It is mounted on a fully-sprung chassis with two pneumatic-tired wheels, and folding doors are added, which can be adjusted for temperature control. Automatic regulation for engine speed is added to ensure that the engine speed varies according to demand for air.

New Welding Process: The "Sigma" (shielded inert gas metal-arc) welding process is a new welding process which has been developed by the Quasi-Arc Co. Ltd., Bilston, England. In this new method of joining metals, the electric arc is shielded by inert-gas and a consumable electrode in the form of a bare wire is used. Currently, the process is mainly used for aluminum and its alloys, corrosion and heat-resisting steels, copper and its alloys and mild steel.

The inert-gas used in Argon for non-ferrous metals and Argon with a small controlled oxygen addition for ferrous metals. The ability to use a continuous bare wire electrode, with no stoppage for changing electrodes, and the fact that there is no slag to remove, enables high welding speeds to be attained, as well as oviating the inclusion of slag in the weld giving welds up to the highest radiographic standard. The process should be of great interest to the oil industry in which welding of the highest quality is required with all the above metals.

The same company has also produced a new metal rectifier set the Quasi-Arc MR 375, the first introduced into the U.K.

Sight Flow Indicators: B. Rhodes & Son Ltd., Romford, Essex, had on display a new series of sight flow indicators, which can be used for measuring or determining the flow of liquids in refinery or petrochemical operations. These indicators are made in different patterns to determine any direction of flowin pipe systems and where the flow is slow and the material dark-colored or opaque, direction indicators are embodied in the main structure.

Root Weld Insert: Rockweld Ltd., Croydon, Surrey, have received the selling rights for the E. B. Weld Insert Process developed by the General Dynamic Corp., U.S.A., the process used in solving some of the welding problems encountered during the building of the atomic-powered submarine "Nautilus." The E. B. Root Weld Insert is simply a wire of special cross section obtained by machining, cold-rolling and cold-drawing. The insert is available in two sizes and in different composition to suit the welding purpose in hand.

In pipe welding the insert is fitted between the two prepared surfaces at the end of the pipes, the internal surfaces of the pipes having been purged with Argon gas. The insert is then tack welded using an Argon arc torch. Completion of the root pass is then made by playing the Argon arc on the insert and joint surfaces, after which the weld is completed in the standard manner.

New Diesel Drilling Engine and Gas Turbine: Ruston & Hornsby Ltd., Lincoln and Davey Paxman & Co. Ltd., Golchester, exhibited a new diesel engine Class 12 ygh which has been developed from the Paxman range of light alloy YH diesels. This engine has been specially designed to run on natural gas for use on all oil well drilling duties.

There was also on view a standard TA gas turbine with a maximum rating of 1,410 bhp shown with covers removed to allow of internal examination. New features of special interest in this machine are the air cooling system for the turbines, and the fully Kinematic construction employed which facilitates rapid starting and stopping of the machine by ensuring that all hot parts are free to expand and contract as the gas temperature changes.

Diaphragm Valve with Electric Actuator: Saunders Valve Co., Cwmbran, Wales, has developed an electrically operated opening and closing mechanism for their diaphragm valves, at present available for their six, seven, eight, ten and 12 inch valves. The unit is arranged for operation with contractor type control gear and can be supplied for local and remote control. The fully open and closed position of the valves are controlled by limit microswitches fitted on the actuator unit. A mechanical indicator of valve position is fitted to the actuator. A hand wheel is provided for emergency operation. Saunders valves are made in cast iron bodies, rubber lined bodies and glass lined bodies.

Controlled Solids Discharge Centrifuge: Sharples Centrifuges Ltd., Woodchester, Stroud, England, have a new controlled solids discharge system for use with their centrifuges called the D.V.2 centrifuge. This consists of a valve operated by the admission of water (or other operating liquid) through a completely separated channel of the centrifuge, so that a solid separated by the centrifuge from a liquid requiring clarification can be discharged at determined intervals with no loss of any fluid.

Thermal and Catalytic cracking of hydrocarbons

By Felix Heinemann and Heinz Heinemann

Our Third Annual Report on petroleum refining patents issued in the United States from May 1954 through April 1955, which was published in WORLD PETROLEUM of July 1955, contained a brief section on patents relating to the cracking of hydrocarbons; it was stated that a more detailed review of this subject was planned for the near future.

This more detailed review is now presented. Some of the patents discussed here have already been mentioned in the Third Annual Review but are now treated in more detail than was possible earlier. The present report includes patents published between March 1954 and the end of August 1955 and relating to thermal cracking, catalytic cracking, cracking catalysts and the regeneration of such catalysts.

Thermal Cracking of Hydrocarbons

The number of patents recently issued in this field is rather large. Quite a few of these patents relate to the use of heated pebbles as heat transfer media and to devices for pre-heating such pebbles. Thus, C. F. Bethea (Phillips Petroleum Co.) in 2,676,909 proposes the concomitant cracking of heavy residua and propane by means of refractory pebbles heated in an upper chamber by combustion gases and gravitating into a first lower reaction chamber where the heavy residuum is coked, whereupon the coke-covered pebbles are regenerated by burning the coke and are thereafter used for cracking propane in a second, still lower reaction chamber. In 2,685,560, the same inventor recommends sealing the reaction chamber from the pebble heater chamber by introducing preheated hydrocarbons into the connecting pebble heater conduit, or by burning a small proportion of the charge material in the presence of an amount of oxygen or air less than stoichiometrically required for complete combustion. Special methods of operating pebble heaters and for the independent control of reaction time and temperature in the reactor of a pebble heater apparatus for cracking hydrocarbons, are given in 2,692,903 of K. H. Hachmuth and 2,694,096 of H. J. Hepp (both to Phillips Petroleum Co.).

Reduction of the viscosity of hydrocarbon oils by thermal cracking, the so-called visbreaking, is described in Shell Development Co. patents 2,687,986 (J. M. Jennings and G. F. Pappas) and 2,695,264 (W. O. Taff, J. Weikart and R. W. Eustis). According to 2,687,986, a first visbreaking is carried out at 850-975°F and a second one at a temperature about 50-100°F below that of the first visbreaking. In accordance with 2,695,264, the thermal cracking severity of the visbreaking operation may be increased without lowering the quality and amount of the fuel oil product by reducing the temperature and residence time of the tar in the separating zone.

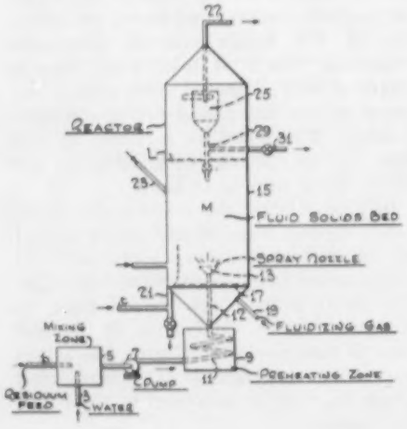
In R. A. Findlay's 2,689,211 (to Phillips Petroleum Co.) the thermal cracking of residual oils at high temperatures is described by a method which avoids the formation of tar mixtures, while E. G. Bailey and R. M. Hardgrove in 2,696,511 (to The Babcock & Willcox Co.) describe the production of butadiene from naphtha at high temperatures and low pressure with low coke formation. In 2,702,782, D. M. Little (Phillips Petroleum Co.) cracks topped crude oil by thermal heating above 890°F in the presence of a gas oil diluent. In 2,698,830 of F. J. Jenny (Texaco Development Co.), a process is described for continuously separating process streams into a relatively low carbon residue fraction, which is continuously subjected to pyrolytic conversion, and a relatively high carbon residue fraction which is burnt with pure oxygen to form hydrogen and carbon monoxide to supply the thermal energy and the physical medium for the cracking operation.

Liquid hydrocarbons are thermally cracked to form fuel gas according to 2,705,195 of C. B. Francis by injecting the liquid centrally into a body of hard hematite at 450°F. The cracking products are oxidized and simultaneously injected into hematite at points downstream from the hydrocarbon injection. A combustible mixture of high fuel value is produced. C. A. Coghlan (2,698,782 to The Texas Co.) gives a combination of thermal cracking with hydrocarbon synthesis processes. In 2,673,831, E. C. Hughes (Standard Oil Co. of Ohio) recommends blending wax slops to be cracked with 10-33 wt. percent of butane, cooling to precipitate the wax, and recovering the butane.

Numerous patents have been published during the period covered by this review relating to fluid coking and similar processes. In Standard Oil Dev. Co.'s 2,670,322 (R. W. Krebs and A. Voorhies, Jr.), naphtha is contacted with olefinic gases and a hydrogen exchange catalyst, such as active carbon, and is then passed into a coking zone where it is contacted with a dense fluidized bed of solid inerts at 1,050-1,150°F, while a residuum is sprayed into this zone above the dense bed and is converted into volatile products and coke. The naphtha present in amounts of 50-75 vol. percent of the total hydrocarbon feed serves as fluidizing medium. F. W. Leffer (Universal Oil Products Co.) in 2,687,992 proposes coking heavy hydrocarbons in a fluidized bed in contact with coke particles and a heat carrying gaseous medium. Coke particles removed from this zone are dried and partially recycled. In J. W. Brown's 2,700,017 (Standard Oil Dev. Co.), residual hydrocarbons are coked in a dense fluidized bed of finely divided solids at 800-1,100°F. Coke particles fromed are withdrawn to a stripping zone and are then mixed with hot combustion gas at 1,300-3,500°F to raise their temperature to 150-300°F above that of the coking zone. The heated coke particles are recycled to the coking zone. In the same company's 2,698,284 (C. E. Adams), residual hydrocarbons are coked in a fluid bed intimately mixed with water and sprayed into the fluidized bed of solids at temperature and pressure such as to cause instantaneous vaporization of water. Good dispersion of the residuum is thus obtained. J. W. Mattox (Standard Oil Dev. Co.) in 2,700,642 recommends contacting heavy residual oils at coking temperature with a fluidized mass of matallic carrier solids. While the cracked hydrocarbons are withdrawn, the coked solids are subjected in another zone to a change in temperature such as to splinter off coke particles because of the difference of the thermal expansion coefficients of metal particles and coke. After removal of the splintered-off coke particles, the metallic carrier is reheated by burning residual coke thereon. R. W. Krebs in 2,709,676 to Esso Research & Engineering Co. produces pelletized coke from heavy oil residues in a first zone on a fluidized bed of coke particles of 300-400 mesh size. The particles of increased size thus obtained are further coked in a second zone in a fluidized bed under conditions to cause augmented particles to cohere and form agglomerate pellets of about 10-100 times the size of the original particles. The pellets formed fall by gravity out of the fluidized bed and are collected at the bottom of the second zone. K. M. Watson (Sinclair Refining Co.) in 2,707,702 describes the coking of hydrocarbon oils at 800-1,200°F in a fluidized bed of coke particles. These particles are then passed to an elutriator to remove the largest particles and to maintain an average size sufficient to permit continued fluidization.

Coking apparatus for liquid hydrocarbons is described in J. M. Bradley's 2,697,069 (G. W. Cabot, Inc.) and in A. H. Schutte's 2,701,788 (The Lummus Co.) which makes use of a bed of inert moving carrier material, while E. S. Pettyjohn (Inst. of Gas Technology) in 2,676,913 proposes an apparatus for coking organic materials with heat generated by burning fuel from silicon carbide tubes in an upper part of the apparatus. Increased yields of motor fuels of improved quality are obtained in accordance with A. Voorhies, Jr. (2,685,559 to Standard Oil Dev. Co.) by a combined thermal and catalytic cracking operation. For this purpose, heavy residua are cracked on hot fluidized inert solids mixed with 3-6 percent of a cracking catalyst. Temperatures are kept above 1,000°F.

Schematic diagram of Patent 2,698,284 to C. E. Adams for coking residual hydrocarbons in a fluid bed intimately mixed with water.



Catalytic Cracking of Hydrocarbons

This subject still continues as one of the most active in the field of hydrocarbon catalytic conversion patents.

In a special group of patents making use of a moving bed catalyst, Socony-Mobil Oil Co. in 2,684,927 (E. V. Bergstrom) employs a colid column of catalyst gravitating through reaction and regeneration zones, or vice-versa. A stream of lift gas enters the lower of these zones, and a mixture of lift gas and contact material is sucked upwards to a separate zone maintained under a vacuum sufficient to accomplish the lifting. The same company's patent 2,705,216 (R. D. Drew) gives another method of contacting gravitating solid catalyst with reactants in a moving bed. R. Kollgard in 2,701,232 (Houdry Process Corp.) contacts hydrocarbons in the liquid phase with a hot solid granular mass, such as a catalyst mass, at suitable temperature in an area above a compact bed of this mass fithin a solid supply zone, communicating with the inlet to a vapor lift system. The vaporous hydrocarbons formed in the transformation are used to move the granular mass into and lift it upwardly to a discharge zone. In 2,704,740 A. G. Oblad and G. A. Mills of the same company propose a method of reducing the rate of attrition of make-up catalyst in a continuous moving bed conversion unit by avoiding subjecting added catalyst containing moisture to thermal shock. For this purpose, the make-up catalyst is contacted with a flowing stream of hot inert gas at a temperature below 300°F to effect moisture removal prior to the introduction of the make-up catalyst into the moving bed system.

A moving bed operation by which a granular

(*Continued on page 70*)

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catalyst is transported between various reaction zones is described in 2,697,685 (F. C. Fahnenshook, S. P. Shambrough and S. C. Howard to Socony Mobil Oil Co.). In 2,695,212, C. H. O. Berg (to Union Oil Co. of California) proposes a method for conveying and lifting of granular solids in substantially compact form under the influence of a concurrent depressuring conveyance fluid. According to G. D. Myers' 2,694,036 (Houdry Process Corp.), the lifting gas employed is a mixture of steam and flue gas from the lower portion of the regenerating zone. In the same company's patent 2,690,540 (W. W. Weinrich), disengaged catalyst particles from a moving bed are conveyed by the lift into a storage vessel, while in the same company's 2,711,386 (J. W. Delaplaine), the lift gas is pressurized by an injection of steam at high velocity into the gas effluent. In 2,676,142, J. A. Crowley (Socony Mobil Oil Co.) transports solid catalyst from a lower reactor to the top of a higher reactor through a series of descending and ascending legs. Each ascending leg reaches higher than the preceding one and the upward transport is carried out by means of a lift gas, whereas the downflow is effected by gravity. The same company (R. D. Drew) in 2,705,216 gives a special method of contacting gravitating solids with reactants in a moving bed.

According to 2,701,875 of C. H. Lechthaler (Socony Mibil Oil Co.) catalyst is added as make-up in a moving bed unit; thus, make-up has a conversion activity which is not substantially greater than the activity of the bulk of the catalyst at the time when the addition is made. In the same company's 2,687,371-2 (V. O. Bowles and F. E. Ray, respectively), apparatus and method are described for operating a moving bed cracking unit using a lift for moving the catalyst upward.

W. A. Pardee and G. E. Elliot (Gulf Research & Development Co.) in 2,706,168 recommend contacting high molecular-weight hydrocarbons at 700-1,100°F with a magnesia-calcium oxide-silica composition to effect catalytic cracking. This composition, containing 1-18 percent CaO, has been pretreated with saturated steam at 250-600°F and then calcined. According to H. Nonnenmacher, W. Oettinger and O. Reitz (Badische Anilin & Soda Fabrik) in 2,709,151, topped crude containing not more than two percent asphalt and at least 12 percent hydrogen is de-ashed and then passed together with added hydrogen at a temperature of 400-550°C and a pressure of 200-800 atm. over a catalyst at 0.2-1.5 wt. space rate. Conditions are selected so as to obtain less than six percent gas and 40-65 percent gasoline per pass. The catalyst employed consists of silicates, silica gel or alumina combined with a minor proportion of a molybdenum or tungsten compound.

Numerous recent patents deal with fluidized operation in the catalytic cracking of hydrocarbons. In 2,686,710 of S. W. Jewell (The M. W. Kellogg Co.), the fluid bed consists of a lower dense phase and an upper dilute phase of lower solids concentration. A confined stream of solids suspended in gases is introduced into the reaction zone above the surface of the dense phase and is deflected downward onto an upper surface of the dense phase. In 2,688,588 of J. W. Beam (Deep Rock Oil Corp.), fluidized particles are transferred from a zone of lower pressure to a zone of higher pressure. G. A. Rehbein (Shell Dev. Co.) in 2,700,641 describes a cracking operation with the use of fluidized solid cracking catalyst which is regenerated when spent. In 2,701,231 C. E. Starr (Standard Oil Dev. Co.) proposes the use of a starting up fluid in catalytically cracking feed stocks high in aromatics. The regeneration temperature must be at least 1,100°F to burn the coke layed down on the catalyst from the aromatics. This temperature is obtained by the use of the special start-up feed stock containing at least 40 percent of aromatics, at least 10 percent of which have fused rings. A method for converting a fluid reactant stream in the presence of subdivided contact material in an improved and simplified manner is described in 2,689,210 by F. A. W. Leffer (Universal Oil Products Co.). The process is carried out in tubular reaction zones such that no contacting chambers of large diameter are needed. According to 2,690,991 of C. E. Adams, C. N. Kimberlin, and W. J. Mattox (to Standard Oil Dev. Co.), high boiling oils are cracked in the presence of a fluidized catalyst. The catalyst particles withdrawn from the reaction zone are regenerated. A portion of the regenerated catalyst is recycled to the same reaction zone, while another portion thereof is combined with a second feed stream under suitable conditions to secure the desired conversion in a suspensoid cracking zone. Cracked product of the first reaction zone is withdrawn overhead, while cracked product of the suspensoid zone is passed through separating means in the top of the first reaction zone to separate it from catalytic particles.

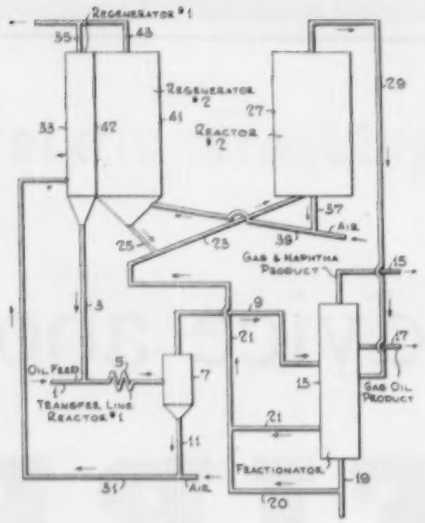


Diagram of Patent 2,681,304 to F. H. Blanding et al for two-stage cracking of hydrocarbons with selected porous silica-alumina catalysts.

F. H. Blanding and J. O. Leslie (Standard Oil Dev. Co.) in 2,681,304 describe catalytic cracking of mixed naphthenic-paraffinic gas oils to form gasoline by suspending in the feed a hot subdivided porous silica-alumina catalyst mixture. This mixture consists of particles of an average pore diameter, of about 60-100 Angstrom to vaporize the feed oils and form a suspension of the catalyst in the oil vapors for a period just sufficient to obtain an overall gas oil conversion of 20-25 percent corresponding to the cracking of a majority of the naphthenic constituents. Volatile effluent and suspended catalyst are withdrawn. The effluent is fractionated after separation of the catalyst to obtain a gasoline fraction, a gas oil fraction and bottoms. At least a portion of the gas oil fraction is contacted with a subdivided silica-alumina catalyst mixture, the particles of which have an average pore diameter of about 20-40 Angstrom, to form a suspension of this catalyst within the vaporized portion of the fraction and obtain within an expanded zone a dense turbulent mass of catalyst fluidized by an upwardly flowing gaseous medium. Under cracking conditions similar to those of the first step, a prevailing portion of the paraffinic constituents of the feed is cracked and an overall conversion of 20-38 percent is obtained. In a related patent to the same company (2,694,673), C. N. Kimberlin, Jr. and E. M. Gladrow propose to crack naphthenic-paraffinic hydrocarbons over a silica-alumina catalyst also consisting of a mixture of particles of an average pore diameter of 60-100 Angstrom and of particles of about 20-40 Angstrom pore diameter. The first named particles will preferentially crack the naphthenes, while the second named particles will preferentially crack the paraffins. The proportions of the two types of particles is determined by the naphthenic/paraffinic ratio of the charge. In accordance with G. L. Matheson and H. J. Hall's 2,711,387 (Esso Research & Engineering Co.), a fluidized catalyst bed is maintained in a contacting zone having a ratio of height to diameter of more than 2:1. This is obtained by controlling the particle size distribution of the solid material. P. Sieke (Gulf Oil Co.) in 2,710,219 proposes fluid cracking of a plurality of separate hydrocarbon fractions in parallel streams with independent space velocity of these streams obtained by adjustment of the rate of catalyst withdrawal from the single compartments of the streams to adjust the height of the fluid bed therein.

In 2,700,638 B. S. Friedman (Sinclair Refining Co.) describes a method for producing naphthalene and gasoline by catalytic cracking of a hydrocarbon fraction rich in alkylated fixed ring aromatics treated in mixture with a light petroleum cycle distillate in the presence of a hydroforming catalyst at 900-1,100°F and 50-1,500 psig. No external hydrogen is required except for the start-up. A. H. Blair (Phillips Petroleum Co.) in 2,689,209 describes a method of removing cracking catalyst from oil in a fractionation column. In 2,714,085 C. M. Thacker and H. O. Folkins (The Pure Oil Co.) propose to crack higher boiling hydrocarbons under suitable conditions of time, temperature and pressure in the presence of a small amount of an explosive compound selected from the group of chlorine tetraoxide, chlorine dioxide, and lead chloride. A method of removing entrained cracking catalyst from oil in a fractionating column is given in 2,689,209 by A. H. Blair of Phillips Petroleum Co.

Cracking Catalysts

Novel cracking catalysts and novel methods for preparing such catalysts are described in a number of recent patents. In Houdry Process Corp.'s 2,669,-547 (H. A. Shabaker) it is proposed to prepare a ground gel powder of improved uniformity as to size distribution by incorporating a minor proportion of dry powdered gel into a hydrosol to be set. The gel has a particle size of at least 2 microns which is the average size range desired for the final product. The set dried gel obtained is relatively weak and can easily be pulverized to the desired size.

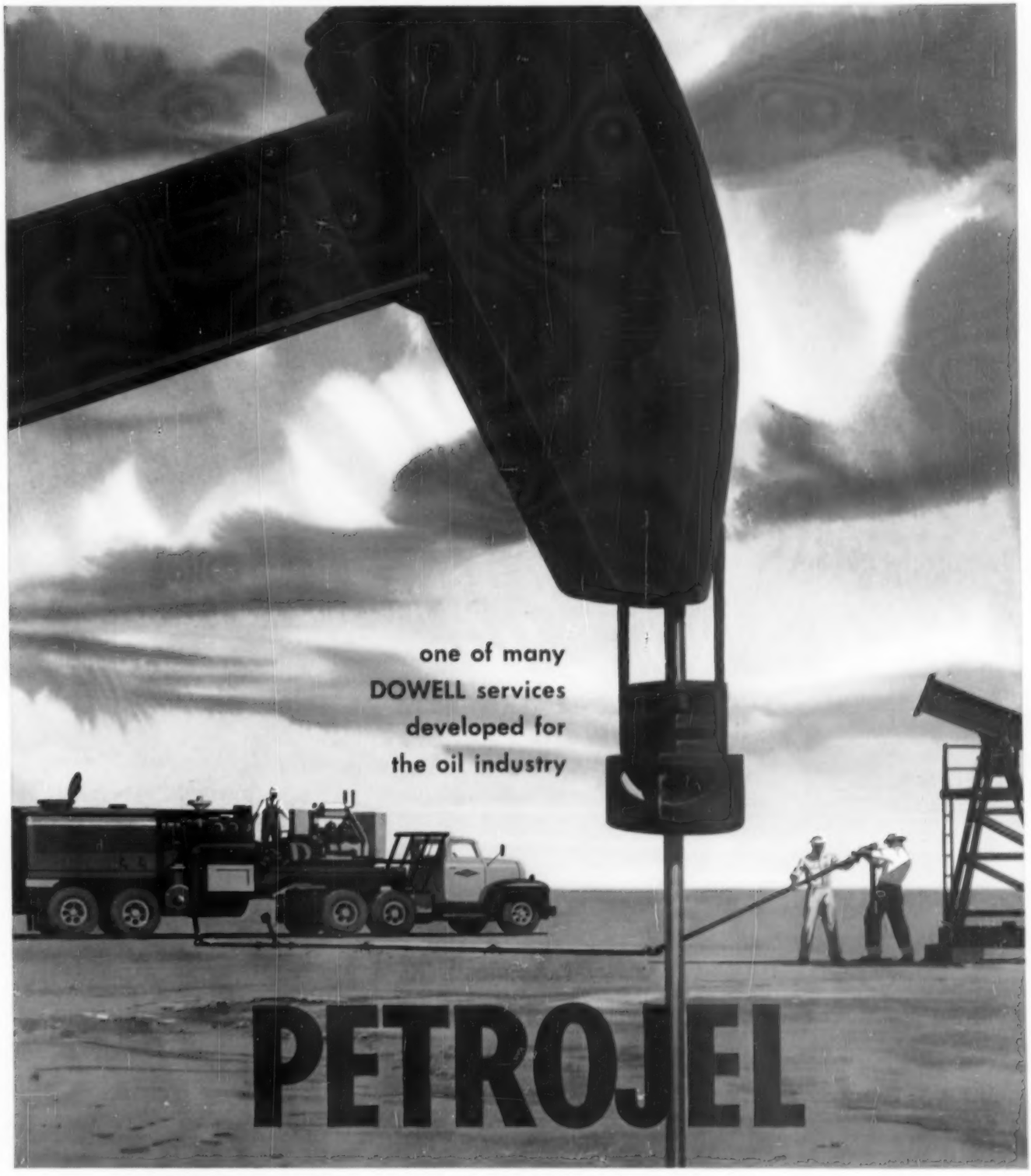
R. E. Schexnailder in Standard Oil Development Co.'s 2,673,188 hydrolyzes an anhydrous aluminum alcoholate solution with a silca hydrogel containing at least 90 percent water. Hydrous alumina is precipitated in silica. The resulting mixture is dried and formed. The catalyst obtained exhibits superior activity and product distribution, is steam stable and of high purity. Mixed alcoholates may also be used in the preparation of the catalyst. J. E. Ahlberg, L. L. Baral and T. O. Tongne (Davidson Chemical Corp.) in 2,680,100 produce a silica-magnesia cracking catalyst by forming a silica-magnesia hydrogel which is washed and dried to obtain an irreversible gel. The gel is treated with water at about 100-212°F for 6-18 hours, redried and activated. The resulting catalyst has increased thermal and steam activity and improved attrition resistance.

In accordance with 2,708,180 of W. V. Fuener, W. Oettinger, H. Nonnemacher and O. Reitz (Badische Anilin & Soda Fabrik), hydrocracking catalysts are prepared on carriers of a special type. For this purpost a waterglass solution which is free of gel-forming substances is mixed with a solution of a metal salt of the second to eighth group of the periodic system, the metal being present therein as the cations. A pH below 7 is maintained in the mixture at conditions such that neither precipitation nor turbidity occurs. Thereafter, an alkaline precipitant is added with such rapidity that again neither precipitation nor turbidity will take place as long as not all reactants have been brought together. A loose powder of low molecular weight silica acid salts of metals of the groups named before is obtained.

Regeneration of Cracking Catalysts

While many of the previously discussed patents describe intermediate regeneration of the catalyst, there are some which are particularly concerned with special regenerating methods. H. M. Stine (Standard Oil Co. of Ohio) in 2,673,187 impregnates untreated aged iron-poisoned silica-alumina cracking catalyst with beryllia in an amount of a fraction of one percent. By this treatment, the severity of regeneration and the loss of fresh feed stock due to oxidation are reduced. In 2,681,305 to Standard Oil Development Co., S. B. Sweetser recommends revivifying spent silica cracking catalyst contaminated with metal type contaminants and restoring the reduced gasoline selectivity of such spent catalysts by continuously circulating the catalyst between the reactor and a regeneration zone of the cobustion type. A portion of the catalyst of reduced selectivity is withdrawn from the system and incorporated with 0.5-5 percent (by weight) of fluosilicic acid at a temperature of 75-150°F, non-

(*Continued on page 91*)



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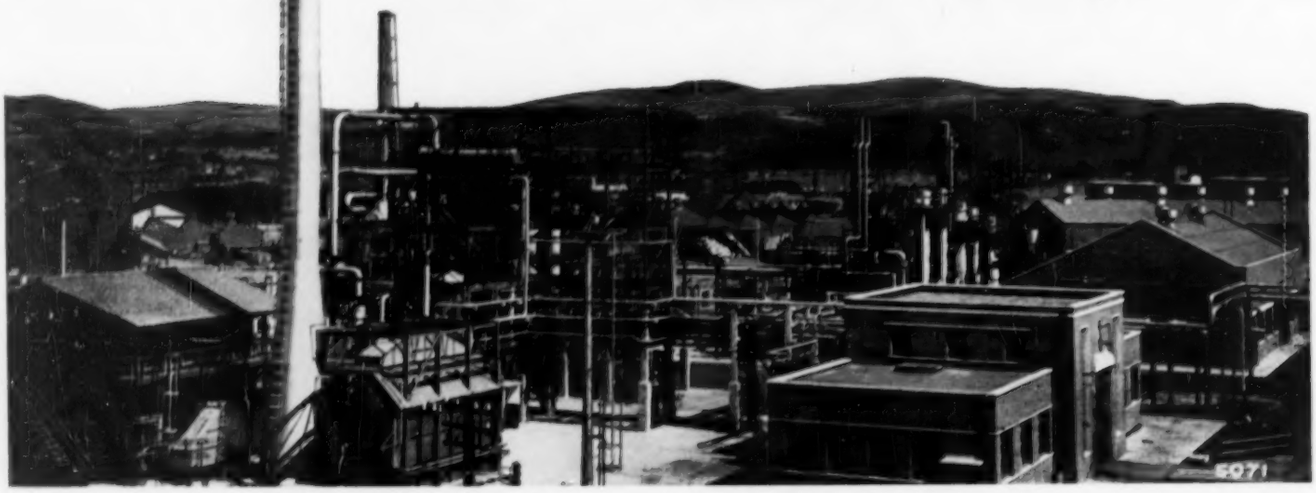
Llandarcy Autofiner, South Wales. Photo by courtesy of The British Petroleum Co., Ltd.

Catalysts for Research and Industry



Commissioned in July 1952, The British Petroleum Co. Autofiner at Llandarcy uses Spence cobalt and molybdenum oxides on alumina catalyst, and has been in continuous operation since that date for the desulphurisation of tractor fuel.

The initial charge of catalyst continues to give entirely satisfactory service. Examination at the end of two years confirmed that the activity and mechanical strength of the catalyst were quite unimpaired.

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A Decade of Oil Progress

(*Continued from page 43*)

Mr. Mead said that the shut-down period between the Supreme Court tidelands decision and the Tidelands Act of 1952 presented underwriters with a period during which they could reflect upon the problems and to make plans for future operations when and if work was resumed in the Gulf. "During that period tailor-made forms of insurance began to develop for the industry," he explained. "A careful study was made of the various risks which existed as well as those projected for the future. Engineers and meteorologists were employed to study exposures in the Gulf of Mexico.

"Thus, when the oil industry commenced operations again, the insurance industry was prepared to provide oil producers and their contractors with insurances at least against the principal exposures to loss. The forms of insurance coverages began to take on a new look inasmuch as many of these forms were tailor-made specifically for this business."

He said the standard drilling rig and equipment forms for the usual land operations were modified to cover the marine risks. Special policies were developed for drilling barges and platforms. Highly specialized insurance, such as "loss of well" and "expense of well control" was made available to those who desired such protection. Oil producers reacted favorably to an integrated insurance program and in many instances they modified contracts requiring their prime contractors to meet specific insurance requirements.

Major oil companies have spent an estimated *$1,116,000,000* in exploration and drilling in the offshore areas of the Gulf of Mexico.

This is an estimate of L. A. J. Monroe, district manager in New Orleans for National Supply Co., based on information furnished by the various oil companies.

This is his breakdown:

Rigs in use	$ 51,000,000
Platforms in use	$ 37,000,000
Drilling barges	$ 28,000,000
Leases	$ 350,000,000
Exploration costs	$ 100,000,000
Drilling costs	$ 350,000,000
Old platforms no longer in use	$ 300,000,000
Total	$1,116,000,000

While American underwriters have played an important role in the offshore development, British companies have taken the lead with respect to multiple risk insurance relating to the offshore oil business. One of the pioneers in this particular field was Mr. George E. Wells of Cravens, Dargan & Co., Houston. Having years of experience with land drilling operations and having the multiple risk facilities of Lloyd's, this Houston firm provided the broadest insurance market for the oil industry. After the tidelands matter was settled by Congress, others in the industry, such as Southern Marine & Aviation Underwriters, Inc. of New Orleans, came along to provide healthy competition in the market.

Offshore operations are enormously expensive. It has been roughly estimated that the investment in oil and gas wells, drilling equipment, barges, boats and machinery scattered along the Gulf of Mexico from Brownsville to the Mississippi River is well over a billion dollars.

Only the major oil companies, and syndicates made up of several of the majors, have the capital to venture into the offshore picture. Therefore, the bulk of this financing is done by the companies themselves without participation of banks and other lending agencies in the area.

Because of the high rate of obsolescence of offshore drilling equipment, the majors are mostly building their own or at least underwriting the construction of the giant drilling rigs, although several have been financed through public stock issues of companies specifically formed for the purpose. Notable among these have been American Tidelands, Inc., which sold 2,000,000 shares of common stock to the public at $1 per share to finance construction of its submersible drilling barge "101," and Zapata Off-Shore Co., whose issue of 315,000 shares at $5.50 was used to finance the LeTourneau drilling platform.

Bankers say the lending agencies probably will not participate in any but short-term loans for the big equipment until the industry has reached some standardization of design. However, there are certain phases of offshore activity which lend themselves to risk capital. While the risks are new and relatively unknown, the local banks are interested in participating in short-term financing, but they are careful that the operators have the experience, the background and the capital.

"This is a man's job," one New Orleans banker pointed out. "There is no need to send boys out to do it."

Consistent with the good banking practices the banks of New Orleans and other Gulf Coast cities are participating in the financing of boats, barges, even helicopters, but they are making sure that the men who come to them to borrow money know their business. For New Orleans banks, whose foundations were built on cotton, sugar cane and shipping, there has been a decided "about face" toward the oil industry within the last two or three years.

"You can look at the changing skyline of New Orleans to realize why," commented one bank executive, vice president, A. E. Alexander of the Hibernia National Bank. "All of the new office buildings, California Co., Shell, Texas, Humble, are the result of the growing offshore operations. The oil industry is not new to Louisiana. Oil was first discovered in this state in 1901; but today the economy of the entire area is geared to what the oil industry is doing in the Gulf of Mexico. The search for oil and gas in the Louisiana and Texas tidelands is creating new industrial life for the South and Southwest. Frankly, I'm about the most bullish banker in the business when it comes to the future of the offshore oil industry."

One result of the offshore oil operations is the creation of an entirely new conception of water transportation which is now undergoing a pioneering stage in design, building and operation. When these things are more standardized, and the pioneering is at an end, the lending institutions prob-

(*Continued on page 91*)

International Paints

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International News and Notes

India Sets Up Oil and Gas Division

The Deputy Education Minister has set up an oil and natural gas division with its head office at Dehra Dun to intensify exploration work. A party drawn from the Geological Survey of India started work in the Jaisalmer area towards the close of the last field season. The reconnaissance work had to be discontinued in the middle of May on account of extreme heat in the desert area. The data obtained was under study.

BP to Build Avgas Plant at Kent Refinery

A 2,600 b/d plant for the production of aviation gasoline is to be installed at the British Petroleum Company's Kent refinery on the Isle of Grain. The plant at Kent oil refinery is expected to be in operation by 1958 and will cost $18,200,000 to build. Considerable savings in dollar expenditures on imports of aviation gasoline from the United States will be realized when this plant goes on stream.

Sohio to Explore in Guatemala

Sohio Caribbean Co. has been incorporated under the laws of the State of Ohio for the purpose of petroleum exploration in Guatemala under that nation's new petroleum code.

Underwater Aluminum Oil Pipeline

The voracious appetite of a small aquatic animal called the Teredo has prompted construction of the world's first permanent underwater oil pipeline of aluminum. The 1,000-foot line recently was welded and submerged in Lake Maracaibo, Venezuela. Engineered by Creole Petroleum Corp. with the assistance of Aluminum Company of America, the aluminum pipe installation will carry crude from an underwater well of Creole's Bachaquero field to a flow station on the lake shore.

Pakistan Mines and Minerals Act

Kaulana Azad, government official, said that two bills would soon be introduced in Parliament to replace the existing Mines and Minerals (Regulation and Development) Act. The two bills would deal separately with mines and minerals, and oil-fields and mineral oils.

Middle East Crude Oil Production

The following crude oil produce figures for the month of September 1955 are announced, including the interesting statement that on Oct. 20, 1955 the Kirkuk field of The Iraq Petroleum Co. Ltd. produced its 150 millionth ton of crude oil. Only four other fields in the world have achieved this cumulative total. One of them is in the Middle East, two are in the Western Hemisphere and the other in the U.S.S.R.

	Production For September 1955 (Long Tons)
Iraq Petroleum Co. Ltd. (Kirkuk Field)	2,027,566
Basrah Petroleum Co. Ltd. (Zubair & Rumaila Fields)	98,079
Mozul Petroleum Co. Ltd. (Ain Balah & Butmah Fields)	107,950
Qatar Petroleum Co. Ltd. (Kukhan Field)	451,152
Kuwait Oil Co. Ltd.	4,121,219
Aramco (U. S. Barrels)	3,888,803 28,777,146
Iranian Oil Participants	1,495,000
Egypt—4 weeks ending Aug. 29 (U. S. Barrels)	812,630
Egypt—5 weeks ending Oct. 3 (U. S. Barrels)	1,010,998

Cuba Holds First Oil Congress

Having brought in its first producing oil well while incidentally stirring up a tremendous amount of interest in possible further developments of its petroleum resources, Cuba has now completed its First Petroleum Congress which convened on Oct. 21 for a three-day session on the campus of the University of Oriente, Santiago de Cuba, Oriente.

Some 200 delegates representing eight countries attended the meeting. Among leading figures in the technical field who took an active part in organizing the program or who presented papers were Dr. C. G. Kirkbride, president of the Houdry Process Corp.; Dr. Harold Smith, director of Region IV of the Bureau of Mines; David L. Caldwell, chief process engineer of Foster Wheeler; Dr. T. J. O'Donnell of Gulf Oil Company's research division; Col. C. E. Cummings superintendent of Texaco's Beacon laboratories; Dr. William L. Owen and E. A. Vasquez distinguished Cuban technologists; A. P. Quarrell of Australia and a group of technical experts of Bataafsche Petroleum Company and the Shell Laboratorium in Holland, who discussed the organization and operation of pilot plants such as the one being organized at the University of Oriente. Owing to the circumstances surrounding the meeting, it developed into a memorial tribute to Dr. Gustav Egloff of Universal Oil Products Co., world famous leader in the technical process of petroleum. Dr. Egloff had been selected to deliver the principal address before the meeting and was to have received the first investiture *honoris causa* in the history of the University. Dr. Egloff's sudden and untimely death just before the date of the Congress upset those plans and instead of the original plan, a Gustav Egloff Memorial address was delivered by Dr. E. Lorenzo-Luaces V, professor extraordinary of chemical engineering in the University and director of the Congress. In a way this was perhaps a fitting close to the career of one of the most active and energetic leaders of technical progress in the modern history of the petroleum industry.

BP Agreement with Italian Refinery

British Petroleum Co. have entered into an agreement with Eduardo Garrone refinery of Genoa for the latter company to refine crude oil to the extent of about 700,000 tons per year to their account.

New Phase in Oil Search in India

The first test well to be drilled in search of petroleum possibilities in the Hugrijan area of Assam was spudded in on Nov. 2. Hugrijan is one of the new areas of oil interest in Upper Assam for which a prospecting license was recently granted by government, the other being Moran where test drilling will begin early in 1956. The site chosen for the test well in the Hugrijan area is at Naoholia, about five miles from Bordubi Road station and close to the northern boundary of the Nahorkatiya Extension prospecting license area, where Wells Nos. 9 and 10 are at present drilling. Drilling is to be by Indian drillers of the Assam Oil Co. A heavy rig capable of 15,000 feet will be used.

Hughes Venezuela Staff Enlarged

A. K. Babel has been appointed to division sales manager for Hughes Tool Co. in northern South America. His headquarters will be in Maracaibo, Venezuela. Mr. Babel has been with Hughes Tool since June 1940. Since 1948 he has had extensive experience in South America.

L. H. Brothers has been transferred to Venezuela. He will be located at Anaco. He formerly was district sales manager at Corpus Christi where he has been succeeded by J. R. Forbes.

Indian Geologists to Study USSR Oil Industry

A delegation of Indian geologists and engineers led by K. D. Malaviya, Indian Minister for Natural Resources left New Delhi in October for the Soviet Union. It will study the techniques of oil exploitation and refining and mineral prospecting in the Soviet Union. It will also discuss with Soviet Union authorities the training of Indians in the science of oil exploration.

Gas Deposits Found in India

Natural gas has been found to occur over a distance of more than 10 miles from Amalapuram in East Godavari to a village in East Godavari across the river. Tentative tests have revealed considerable deposits of gas. Surveys and tests are being conducted by a geological survey team of Andhra University on behalf of the state government. Earlier hopes of large deposits of lignite in Amalapuram area had been belied by field tests.

Pakistan Reduces Sales Tax and Import Duty

The government of Pakistan has abolished sales tax or Rs 6/5/2 per ton on furnace oil and reduced duty on motor gasoline to the extent of AS -/2/6 per gallon. The import duty was reduced on motor gasoline by /2/6 per gallon, and brought an immediate corresponding decline in the prices of gasoline to 2/10/ on September 15.

Iranian Oil Participants Appointment

J. Addison has been appointed general manager of Iranian Oil Participants, Ltd., the shareholding company of the two operating companies, succeeding H. E. Snow, who had held the post since the formation of the company last year, and has been reappointed a managing director of the British Petroleum Co. Ltd. Mr. Addison was secretary of the company prior to his appointment as general manager. He joined British Petroleum in 1946 and since then has been closely concerned with oil activities in the Middle East. He was one of the representatives of the international group of companies which last summer formulated the present oil agreement with Iran. K. L. Le Page succeeds Mr. Addison as secretary of B.P.

(*Continued on page 90*)

OIL AND GAS LAWYER. Large oil company, engaged in all branches petroleum business overseas, desires attorney for its legal staff with 5-10 years' experience in oil and gas law. Must be personable and willing to travel extensively abroad. Applicants should furnish detailed resume of educational background and legal experience and indicate salary desired. *Write care Box 10. World Petroleum.*

BP WORKS WHILE OTHERS SLEEP

WHILE MOST OF THE WORLD sleeps, The British Petroleum Company's refineries and distribution organisation are working for the benefit of mankind.

The child's night-light is a small example. The world demand for energy has doubled in the last twenty years and goes on increasing. Oil supplies two-thirds of this energy.

BP makes an impressive contribution. About seven hundred and twenty thousand barrels of oil were produced each day last year. There are fourteen refineries in nine countries and one of the world's largest privately-owned tanker fleets to carry the oil. The Company's marketing organisation encircles the world.

Half a century of enterprise and continuous progress have put BP among the world's largest and most progressive oil companies.

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Canadian Notes

Canadian Westinghouse President and Directors

George L. Wilcox, former executive vice president of the Westinghouse Electric International Co., New York, has been appointed president and director of Canadian Westinghouse. Two new directors have also been appointed: W. E. Phillips, of Toronto, president of Duplate Canada, Ltd., and L. E. Osborne, vice chairman of Westinghouse Electric Corp. The intention of the company is to elect, in addition to Mr. Phillips, other Canadian directors to its board so that not only the independent shareholders, but also the entire Canadian economy will be substantially represented.

Opens Lube Plant

Imperial Oil's new $13 million lubricating oil plant at Edmonton, the first to be built in western Canada, was opened Nov. 2 by Premier E. C. Manning of Alberta. The new plant makes 41 types of oil for use in the prairie provinces, British Columbia and the Canadian northwest. With a capacity of 70,000 gallons a day, it is the second largest lubricating plant in the country, exceeded only by Imperial's plant at Sarnia, Ont.

The new plant uses several processes developed by Imperial's research department over a period of years. One of them, called hydrofining, is being used for the first time in North America in a full-scale-application to lubricating oils.

First sod was turned for the new lubricating oil plant in July, 1954. Work was completed this month by Canadian Kellogg Co. with a force of up to 550 men. Utilizing the crude oil from the Leduc field which Imperial discovered in 1947, the new plant brings the company's investment in Alberta to $165 millions.

S. C. Burnet

Appointed Sales Manager

S. C. Burnet has been appointed manager of Shell Oil Company of Canada Ltd. He will make his headquarters at the company's head office in Toronto from where he will direct the sales of all Shell products throughout Canada.

Contract Awarded for Pipe

Britain's Chancellor of the Exchequer, R. A. Butler has announced the awarding of $12,000,000 contract for supply of 30-inch pipe for the natural gas pipe line proposed by Westcoast Transmission to run from the Peace River fields of Alberta and British Columbia. The pipe will be supplied by the South Durham Iron and Steel Co. which operates the only pipe mill in the British Commonwealth capable of supplying 30-inch pipe.

The award means the South Durham firm, which enlarged plant facilities to bid on the Westcoast order, will supply about one third of the material for the entire 650-mile line, which will link the northern British Columbia town of Fort St. John with Vancouver and the Pacific Coast.

Preliminary work on a 20-mile stretch of the line's southern extremity has already started in the Huntington area of the Fraser Valley near Vancouver with material imported from the United States. The British pipe is expected to be delivered next spring.

New Edition Published

Nickle Map Service Ltd. of Calgary, Canada has published its second edition of "Oil and Gas Wells in Western Canada." A map scale has been enlarged which adds to the value of this handy brief case or desk reference.

Houdriflow Cracker on Stream

The 16,600 barrels-per-day Houdriflow catalytic cracking unit, designed to produce high yields of high octane gasoline went into operation October 11 at the new refinery of Canadian Petrofina, Ltd. at Montreal, Canada.

Charge to the Houdriflow cracker is at present light and heavy gas oil from the refinery's vacuum distillation unit and will include in the future gas oil from a coking unit. Of the total charge to the Houdriflow 10,000 b/d will be fresh feed and the remaining 6,600 barrels will be a recycle stream, heavier than diesel oil.

Canadian Gulf Signs Gas Contract

Canadian Gulf Oil Company, a subsidiary of Gulf Oil Corp., signed a contract Oct. 24 with Trans-Canada Pipelines, Ltd. for the sale of 170 mcf per day of natural gas. The term of the contract is 25 years. The gas to be purchased by Trans-Canada Pipelines will come from Canadian Gulf holdings in the Pincher Creek field in southwestern Alberta. It will be transported by Trans-Canada to eastern Canadian markets. Canadian Gulf Oil Co. is said to be the first major supplier to enter into a long-term contract with Trans-Canada Pipelines.

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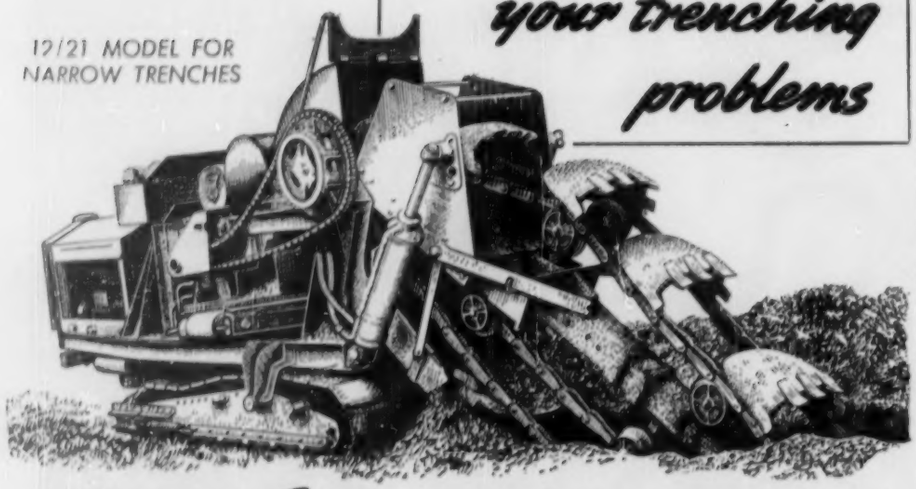
12/21 MODEL FOR NARROW TRENCHES



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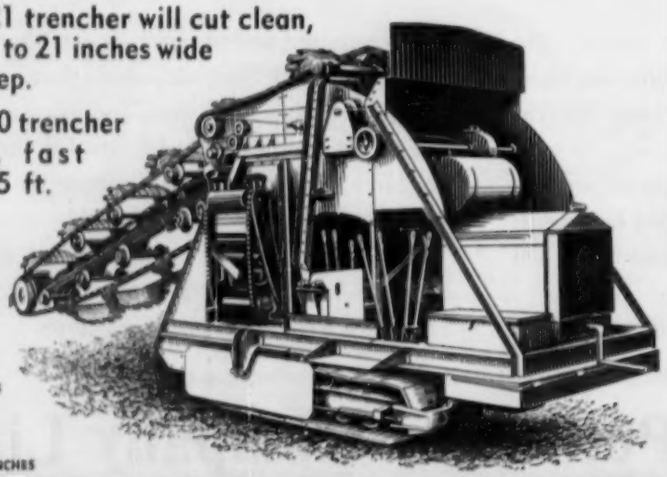
The Model 16/60 trencher will cut clean, fast trenches up to 5 ft. wide down to 14 ft. deep.



Illustrated catalogues sent on request.

16/60 MODEL FOR WIDER TRENCHES

JOHN ALLEN & SONS (OXFORD) LTD. COWLEY OXFORD ENGLAND

Appointed Montreal Refinery Manager

L. T. Wilson has been appointed manager of Shell Oil Company of Canada's Montreal East refinery. He started with Shell in 1933 as a junior inspector at the company's Wilmington, Calif. refinery and has risen steadily in Shell's manufacturing department, interrupted only by military service in World War II. Since the war he has been successively senior technologist, assistant manager of the catalytic cracking department, assistant superintendent and superintendent at a number of Shell refineries. He came to his new post from Shell's Norco, La. refinery where he was superintendent.

First Canadian Offshore Wildcat Completed

Harold L. Strader, Houston drilling contractor, has completed the first offshore wildcat in Canadian history in Lake St. Clair 5-A a mile offshore in Lake St. Clair northeast of Detroit in 15 feet of water. The discovery gasser was drilled for Lake St. Clair Gasfields Ltd. of Toronto. On a preliminary test through perforations at 1,464-77 feet the well tested at a calculated open flow rate of 2,000 mcf per day after acidising. This is one of a series of several wildcats the operators have drilled in the lake to test a number of gravity meter anomalies.

Canadian Oil Companies Appointments

Canadian Oil Companies, Ltd. announces the formation of its new producing department with headquarters at Calgary, Alberta. J. B. Webb is appointed manager of the department, and will also continue as exploration manager. H. G. Bagnall is now operations manager in charge of all producing and drilling operations; W. M. Luthy is development manager responsible for the development of new projects dealing with the company's crude oil production. These gentlemen will aso comprise an executive committee responsible for the development of the department objectives with Mr. Webb as committee chairman. Mr. Webb and Mr. Bagnall were formerly executives of the Anglo-Canadian Oil Co., Ltd. which merged recently with Canadian Oil Companies Ltd.

Imperial to Construct Gas Processing Plant

Construction of a 10 mmcf gas processing plant to handle gas obtained with oil production from Redwater field will be completed by the end of 1956, it was announced in November by W. B. Dingle, Edmonton division manager for Imperial Oil Ltd. Brown and Root Ltd., Calgary construction contractors, have been awarded the contract for construction of the pipe line gathering system. Both these contracts were awarded on the basis of low bids. The plant will go into operation by the end of 1956 and the total project is expected to cost approximately $3 million.

To Drill in Quebec

Imperial Oil Ltd. has announced an exploration program for the province of Quebec in 1956. A number of drill sites have been selected for stratigraphic tests and one or two wildcats also will be drilled next year.

Rust Penetration Study

Batelle Memorial Institute has completed a study of rust penetration by a protective coating based on fish oil. Radioactive tracers were employed. Sponsor was Rust-Oleum Corp., Chicago.

GSI Middle East Division

Peter S. Stoutjesdyk will be manager of the new Middle East Division of Geophysical Service Inc., Dallas, Texas. Division headquarters will be in Cairo, Egypt, and will operate within the company organization of Geophysical Service International, S.A., an Eastern Hemisphere affiliate of the Dallas organization.

Architects model of the new HTL plant to be built on the Buffalo Speedway in Houston. Ford, Colley, Tamminga are the architects of the 400,000 square foot completely air conditioned building.

Thermal Production Experiment

An experiment in *in situ* combustion for the secondary recovery of heavy crude oil has been started in the South Belridge field, Kern County, Calif., by General Petroleum Corp. and others. The experiment is expected to take two and one-half years and to cost about $1 million.

Other companies having an interest in the experiment are: Continental Oil Co., Esso Research and Engineering Co., Gulf Oil Corp., Honolulu Oil Corp., The Ohio Oil Co., Shell Development Co., Sunray Mid-Continent Oil Co., The Texas Co., Tide Water Associated Oil and Union Oil Co.

Purpose of the South Belridge field experiment will be to ascertain if thermal recovery is feasible from both an engineering and economic point of view as a secondary recovery method for producing low gravity crude which is unrecoverable by any other means.

Laboratory tests of thermal recovery over the past eight years and a pilot experiment three years ago indicate that the heat generated by burning a small amount of oil underground in a reservoir sufficiently decreases the viscosity of the remaining oil, permitting its recovery when it is pushed toward producing wells by air or gas. In the pilot test, conducted in a south Oklahoma oil field in 1952, combustion of a small amount of the oil in place resulted in recovery of a substantial quantity of the original oil. Combustion of the oil in place is achieved by igniting it after the oil sands have been permeated by air pumped into the zone through an injection well.

The experiment will be conducted in the upper portion of the Tulare oil zone, at a depth of approximately 700 feet, which produced 13° gravity crude oil. This zone is similar to a number of other California producing zones which contain large quantities of heavier crude oils at the termination of primary production. Success of the thermal recovery process in this experiment could lead to other tests which may develop a commercially practical method for producing in California untold quantities of what is now regarded as unrecoverable oil.

The South Belridge field test of the thermal oil recovery method will utilize a five well pattern, having four production wells centered on one injection well. The production wells will be located 330 feet apart. Also included in the proposed pattern are four observation wells.

The thermal recovery process to be used was developed by Magnolia Petroleum engineers as a joint research project by Socony Mobile Oil Co. and its affiliates, Magnolia and General Petroleum. Magnolia engineers will serve as advisors in the South Belridge field test.

New Antiknock Compound

Ethyl Corp. has introduced an improved "Ethyl" antiknock compound for motor fuels, to be known as Motor Plus. The new additive acts to curb the increase in gasoline octane requirement of automobiles by reducing engine deposits.

To Construct Polyethylene Plastic Plant

Phillips Chemical Co. has awarded a contract to Farnsworth and Chambers Co., Inc., Houston, for the major portion of construction work on a 110-million-pound-per-year plant to manufacture its polyethylene plastic discovery, trademarked Marlex.

Cosden to Build Products Line

Cosden Petroleum Corp. plans to build a six-inch products pipe line from its Big Spring, Texas, refinery to its products terminal at Abilene, Texas, a distance of one hundred miles. Cost will be about $1,500,000. It will transport ten different grades of gasoline, jet fuel and two grades of distillate.

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British Oil News

By E. Lawson Lomax

Last month notice was given that British Oil companies and shipping companies had placed orders for the construction of 67 new tankers, totalling about 1,562,000 dwt. Further information has been released by British oil and shipping companies to the effect that 39 more tankers with a total capacity of 1,232,000 dwt have been placed on order during the past month, the total being 106 tankers with a total dwt of 2,794,000. In addition, four tankers of a total dwt of 130,000 have been ordered by the Persian Government.

Of the 39 tankers, 25 are to be built in British yards, eight in German yards and six in Italian yards. The six tankers being built in Italian yards are for the British Tanker Co. and are the first orders to be placed by the company outside of the U.K. The ships are to be delivered during 1958 and 1959 and were ordered outside the U.K. because facilities in the U.K. of sufficient experience in the building of this class of tanker and which could provide delivery by specified dates were not available. Early delivery was therefore the main factor which led B.P. to depart from its traditional practice of U.K. building. B.P. noted, however, that "a great measure of control of labor and material costs during construction of the ships has been found possible in negotiating with shipyards abroad than with the British shipbuilding firms."

Sixteen vessels of 34,500 dwt each, six of 42,500 dwt and one of 32,000 dwt have been ordered by British Tankers Ltd., all will be steam turbine driven with projected speeds of 15½ to 16 knots. When this order is completed, and old ships have been disposed of the British tanker fleet will be 178 ships of about 3,130,000 dwt.

The Eagle Oil and Shipping Co. Ltd. (Shell Group) has ordered four ships of 32,000 dwt and three of 18,000 dwt from British yards, all of which will be steam turbine propelled. After allowing for obsolescence of older vessels, the delivery of the above vessels by the end of 1959 will bring the dwt of the Eagle fleet to over 500,000. Shell Tankers Ltd.'s orders are for three 32,600 dwt and six 18,000 dwt tankers, of which all but one 32,000 dwt tanker will be built in German yards. The propelling machinery for these tankers has not been announced, but it will probably be by steam turbines for the 32,000 dwt vessels, and may be motors or steam turbines for the 18,000 dwt tankers.

The Confederation of Shipbuilding and Engineering Unions has called for an inquiry into British shipbuilding orders being placed in foreign yards, but it would appear that the oil and shipping companies are quite justified in this action. They have a large amount of trade in the foreign countries concerned, and therefore that country's currency available for payment. In view of the remarks of B.P. with regard to control of price, it is evident, although not definitely stated, that better value for money is possibly being obtained.

It would seem that the increasing demand for higher pay, without increasing production, is bound eventually to damage the position of the British tanker industry since tanker contractors cannot continue to place orders for tankers without knowing the limit of costs as they have been doing in the past few years.

Messrs. Vickers, Ltd., announce that as from January 1, 1956, Vickers-Armstrong (Shipbuilding) Ltd., will take over the business of shiprepairers, constructional engineers and galvanizers carried on at Hebburn and Jarrow by the group company, Palmers, Hebburn Co. Ltd., and the establishments will be known as the Palmer Hebburn Works of Vickers-Armstrongs (Shipbuilders) Ltd.

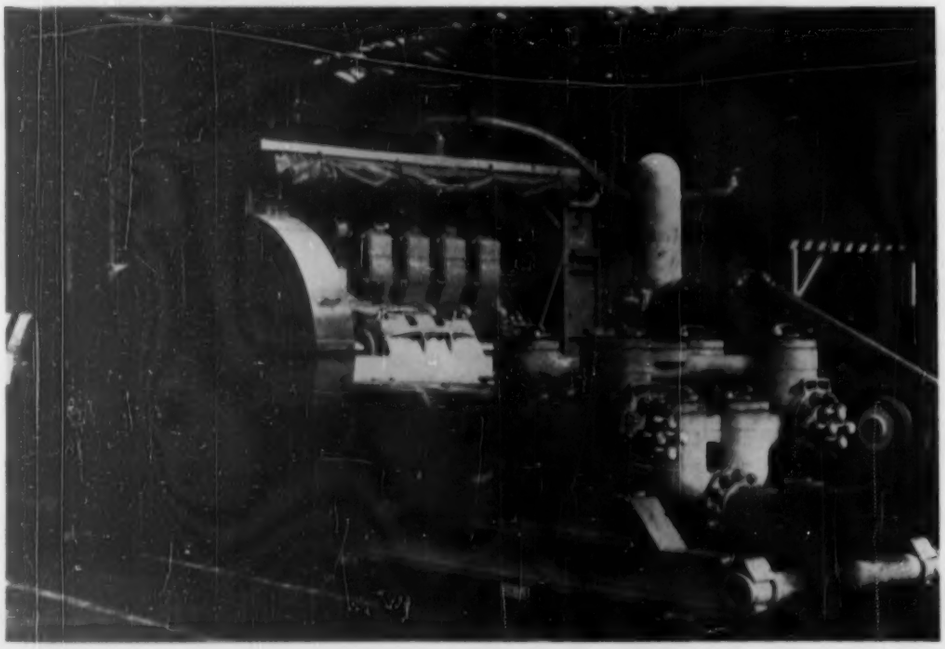
It will be remembered that on July 1, 1955 Vickers-Armstrong (Shipbuilders) Ltd. took over the shipbuilding business of Vickers-Armstrongs Ltd. at Barrow-in-Furness and the Naval Yard, Walker, Newcastle-on-Tyne.

Furness Shipbuilding Co. Ltd. announce that the 18, 190 dwt Motor Tanker "Karmt" built by them to the order of Messrs. Skibs A/S Corona of Hangesund, Norway successfully passed its sea-going trials on Oct. 7 and has been handed over to its owners.

Messrs. Bartram & Sons, Sunderland announced that the 16,900 dwt motor tanker "George Lyras" built by them to the order of Marine Enterprises Ltd. (Managers Lyras Bros. Ltd., London), and the largest vessel built at their yard in their 118 year's building experience, successfully passed her trials on Sept. 27 and was given over to her owners. Messrs. Harland and Wolff Ltd. announced that the 31,500 dwt turbine-driven tanker "Vibex" built by them to the order of Shell Tankers Ltd. has also been handed over to her owners after successfully passing her sea-going trials.

The third vessel of Shell-Mex and B.P. Ltd's estuarial fleet of tankers was launched at the Wallsend-On-Tyne yard of Clelends (Successors) Ltd., the naming ceremony being graciously performed by Mrs. Opher, wife of W. D. Opher a director of Vickers-Armstrongs (Engineers), Ltd. who named the vessel "B.P. Miller."

IDEAL-OWECO type C350 slush pump with English Electric 8V package unit in background.



Vacuum Oil Co. Introduces New Lubricant

On Oct. 16, the Vacuum Oil Co. introduced a new all-season, all-weather motor oil on to the British Markets, claiming that it will reduce corrosive and mechanical wear, improve engine performance and save gasoline. The new oil is sold under the brand name of "Mobiloil Special." It has been subjected to a very comprehensive series of road and bench tests, carried out on British, American and European cars and engines, which have covered over two million miles of various road operations and involving the use of nearly 300 cars, and many hours of laboratory engine testing.

While the oil has been manufactured to meet the demands of the newer higher compression ratio engines, it is still said to be quite safe to use on older cars, improving their performance and prolonging engine life.

Trinidad Petroleum Development Co. Ltd. Annual Report

The report and balance sheet and profit and loss account for the year ended July 31, 1955 shows a net profit of £403,095. The balance of unappropriated profit from last year was £202,515, making a total of £605,610. After deducting therefrom: the dividend paid on 5½ percent, preference capital and the interim dividend of 3¾ percent tax free on the ordinary capital paid on May 12, 1955, the balance available was £546,671. There has been transferred to preference capital redemption account £7,221, general reserve £150,000. The directors recommended the payment of a final dividend on the ordinary capital of 19½ percent, tax free, on Nov. 18, 1955 making 23 percent tax free for the year, to shareholders on the register of members on Oct. 27, 1955, which will absorb £192,500, leaving to be carried forward £196,950.

The total output of crude oil amounted to 3,434,239 barrels or 9,409 b/d as compared with 3,319,941 barrels the previous year. Sales of crude oil during the year amounted to 3,406,059 or 9,332 b/d.

At July 31, 1955 the area on the mainland over which the company held oil rights was 74,635 acres compared with 73,789 acres at the end of the previous year. The company also holds a marine oil mining license from the government of Trinidad and Tobago covering some 255,000 acres of marine areas in the Gulf of Paria and off the South Coast of Trinidad.

Assam Oil Today

The Assam Oil Co. is following the lead of other oil companies in the Eastern Hemisphere and has produced a very interesting report on the company's activities during 1954, with those of 1953 in perspective. Production at 78,175,080 Imperial gallons is the highest in the company's history and represents a 13 percent increase in production over that of 1953, this being largely due to the new wells at Nahorkatiya and East Kaharjan.

Personnel

A. Hofland, O.B.E., has been appointed a director of The Shell Petroleum Co. Ltd. and The Anglo-Saxon Petroleum Co. Ltd. as of October 21, 1955.

E. E. de Bruijn, co-ordinator exploration and development group, and J. L. van Krimpen, co-ordinator manufacturing group, have been appointed deputy directors of the company with effect as of Oct. 21 by resolution of the board of director of N. V. de Bataafsche Petroleum Maatschappij.

David Drummond has been appointed to the public relations department of Esso Petroleum Co., Ltd., in an editorial capacity as of Sept. 5, 1955.

Dr. C. G. Williams, director and general manager of "Shell" Research Ltd., was appointed on Oct. 7 to the chairmanship of the Automobile Division Council of the Institution of Mechanical Engineers for its 1955/56 session. Dr. Williams has been associated with the Institution for over 25 years and was elected to its council in 1950. The retiring chairman is J. H. Pitchford managing director of Ricardo & Co. Engineers (1927) Ltd., Shoreham-by-Sea.

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Oil Company Staff Changes

DR. B. B. BANERJEE has been made group leader of the diffraction group in the physical metallurgy section, materials division of Standard Oil Company (Ind.) engineering research department. He joined the company's engineering research department at Whiting in 1951 as a research engineer and has been an assistant project engineer since 1953.

H. R. BOLTON has been elected president and N. K. Anderson as vice president of Hugoton Plains Gas and Oil Co. Mr. Bolton is vice president, exploration and production of Crescent Corp. Dr. Anderson is director of research and development for Crescent and will supervise sales for Hugoton.

WILLIAM O. STEPHENS has joined International Petroleum (Colombia) Ltd.'s Barrancabermeja refinery as instrument foreman. He had previously worked for Shell Oil Co. in Deer Park, Texas, since 1941.

John Kingston has arrived in Cartagena, Colombia, where he will be process superintendent for the new refinery being constructed there by International Petroleum (Colombia) Ltd. Mr. Kingston brings with him a broad background in process operations obtained at the Everett refinery of Esso Standard Oil Co.

R. B. ACKER, manager of the employee relations department for International Petroleum Ltd. at Lima, Peru, has been named to the staff of International's recently created office of executive representative in Bogota, Colombia. He will follow employee and public relations as well as medical activities in International's operations in Colombia.

C. B. Weidenbacker succeeds Mr. Acker as manager of the employee relations department at International. Until his recent promotion, Mr. Weidenbacker was manager of employee relations for International Petroleum (Colombia) Ltd. at its Barrancabermeja refinery.

ROBERT B. FRALEIGH has joined International Petroleum Co., Ltd. at Talara, Peru, as a junior geologist. Mr. Fraleigh comes to International from Imperial Oil, Ltd.

Dr. E. O. Hook

Dr. W. S. McClenahan

DR. E. O. HOOK, formerly with the American Cyanamid Co. at Stamford, Conn., has joined the Standard Oil Co. (Ohio) research staff as coordinator of the mobile power lubricants and mobile power fuels process sections at Sohio research laboratory. Dr. W. S. McClenahan, formerly with the Mellon Institute in Pittsburgh, becomes coordinator for the petrochemicals industrial products and basic research sections.

Promotions include: Dr. Harry M. Stine, to administrative supervisor in Sohio's chemical and physical research division; Dr. S. M. Darling to section supervisor in the mobile power lubricants section; Dr. Frank Veatch, to section supervisor in Sohio's petrochemical section; Dr. A. L. Jones to section supervisor of Sohio's basic research section; Dr. H. A. Strecker, to section leader in the mobile power fuels process section; and H. A. Hardman to senior research associates in the industrial products section.

George Koegler

GEORGE KOEGLER, now executive assistant to the chairman of the board, has been appointed deputy general counsel of Standard Oil Company (N.J.). E. F. Johnson, general counsel of the company, has elected to retire in 1956 on completion of 30 years service with the company to resume general legal practice.

Before joining the Jersey Standard legal department in 1943, Mr. Koegler was a member of the New York law firm of Kellogg, Emery & Inness-Brown and its successor Satterlee, Warfield and Stephens.

Mr. Johnson joined the legal staff of Jersey Standard in 1926. He was appointed general attorney in 1941 and became general counsel Jan. 1, 1945.

MITCHELL STARK has been appointed producing superintendent for International Petroleum Co. Ltd. at Talara. He joined Humble Oil in 1938 and except for three years of military service from 1942 to 1945, continued with them until 1951. He joined the staff of the producing coordination department of Standard Oil Co. (N.J.) in New York, in 1951, the position he held just prior to joining International.

DR. DANIEL C. HAMILTON has been named manager of the economics department of The Atlantic Refining Co. E. T. Knight, former acting manager, has been named associate economist. Dr. Hamilton comes to Atlantic from Standard Oil Co. (N.J.) where he served as industrial economist.

Dr. Daniel C. Hamilton

JOHN J. LEU, sales operation vice president of The American Oil Co., retired after more than 41 years of company service. Mr. Leu, who has served as a company vice president since 1950, started his career in the oil industry in 1914 as a clerk in Keokuk, Ia., for Standard Oil Co. (Ind.) parent company of American. After a series of promotions, he was transferred to the east coast subsidiary in 1930.

ARTHUR M. SHERWOOD has been appointed assistant secretary of Socony Mobil Oil Co., Inc. He had served as legal counsel since joining Socony Mobil in March 1954 and was previously associated with the law firm of Shearam and Sterling and Wright, New York.

H. A. METZGER has been appointed manager of the Dakotas District of the White Eagle division of Socony Mobil Oil Co., Inc. He succeeds the late C. W. Shields with headquarters in Aberdeen, South Dakota.

DALLAS R. LAMONT has been elected to the board of directors of Socony Mobil Oil Co., Inc., in charge of the company's research and development program and of its laboratories. He succeeds William M. Holaday, who has headed Socony's Mobil's research and development activities since 1944 and who has been appointed to a new position as coordinator, new product planning.

CHARLES E. MAIN has been named chief engineer of the Eastern pipelines division of Socony Mobil Oil Co., Inc., in Plainfield, N. Y. He succeeds George F. Brigance who has retired.

HENRY E. McAULIFFE has been named vice-president and general manager of Mobil Oil Company de Colombia. He succeeds A. D. Graves who is returning to the company's New York office to serve as an assistant to the producing committee member responsible for eastern hemisphere operations.

Mr. McAuliffe joined Socony Mobil as a petroleum engineer in 1945. Since 1950 he has been in charge of special studies in the producing department. He is a past chairman of the New York Petroleum Section of the American Institute of Mining and Metallurgical Engineers.

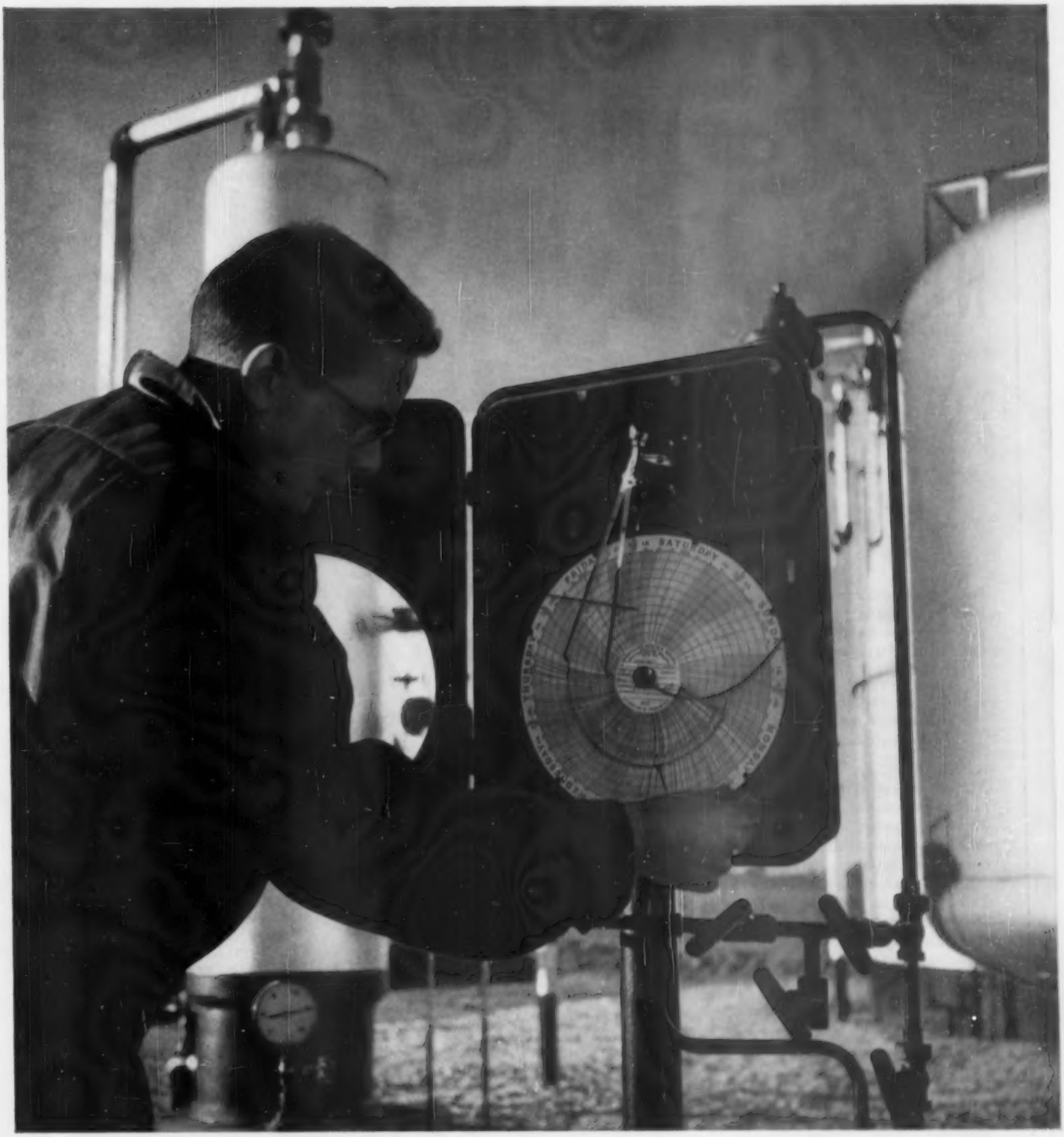
G. I. Parkhurst

T. L. Lenzen

T. L. LENZEN and **G. L. PARKHURST** have been appointed directors of Standard Oil Co. of California. Mr. Lenzen has been manager of California Standard's Eastern Hemisphere operations and since 1938 closely affiliated with Middle East oil developments where he spent considerable time abroad as a coordinator in the administration of California Standard's interests in the Eastern Hemisphere. He is a director of the Bahrain-Caltex group of companies, and affiliate of California Standard. Mr. Lenzen joined the company in 1928 after graduation and graduate work in electrical engineering at Stanford University.

Mr. Parkhurst, a vice president since 1949, previously was president of Oronite Chemical Co., chemical marketing subsidiary. Prior to World War II he was in the petroleum industry in the Middle West and during the war he served with the Petroleum Administration for War. He joined Oronite in 1946. Mr. Parkhurst is a director of Arabian American Oil Co. and Trans-Arabian Pipe Line Co. He was graduated from and did graduate work in chemistry at Illinois Institute of Technology and holds a Doctor of Law degree from De Paul University.

(Continued on page 86)



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—From an address by M. J. Rathbone, President, Standard Oil Company (New Jersey)

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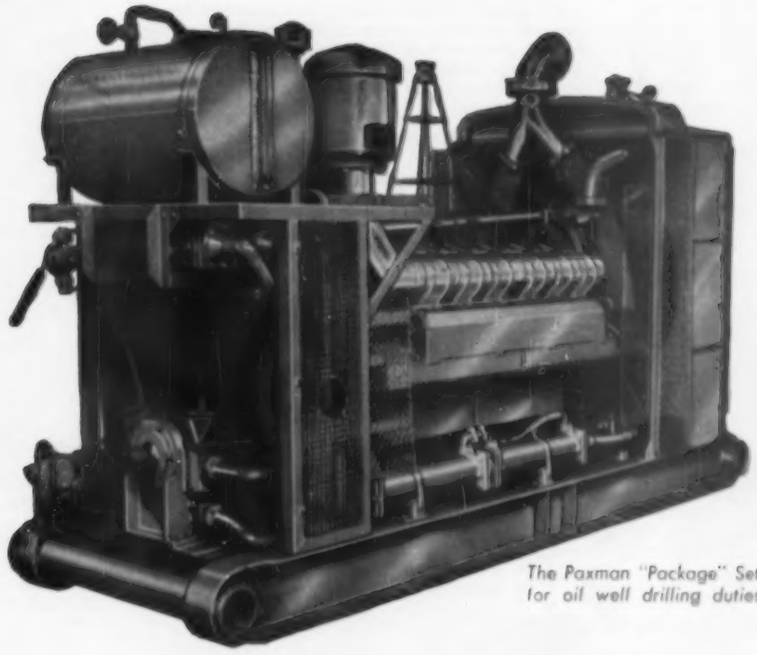

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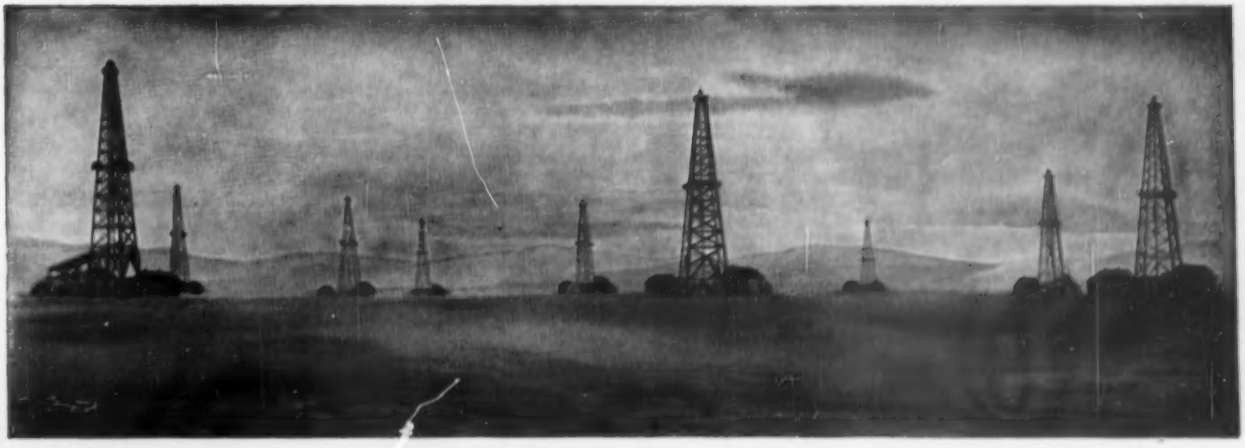


Oil Company Staff Changes

(Continued from page 82)

LYLE R. DUTY, formerly administrative assistant to the president, has been elected secretary of Pan-Am Southern Corp. to succeed the late P. J. Schowalter. A specialist in office methods and procedures, Mr. Duty began working for Pan-Am Southern on a temporary "loan" basis from Standard Oil Co. (Ind.) in August, 1950. He was assigned to Pan-Am on a full time basis on Jan. 16, 1951 as assistant to the executive vice president and was named administrative assistant to the president of Pan-Am on June 4, 1952.

WILLIAM O. BARNES has been appointed industrial relations supervisor for the eastern division, Tide Water Associated Oil Co., succeeding Seth W. Candee who retired after 30 years of service with the company. Mr. Barnes started with the company in 1925 at Associated, Calif.

D. J. STARK has been appointed plant manager for Escambia Bay Chemical Corp. at Pensacola, Florida, where the company has a multi-million dollar petrochemical plant under construction. Prior to 1951 when he joined Escambia, Mr. Stark was manager of the National Petrochemicals Corp. plant at Tuscola, Ill.

W. L. PEYTON has been promoted to assistant to the manager of Continental Oil Company's headquarters geological section in Houston. He formerly was division geologist for Conoco at Oklahoma City. E. F. Culp, Oklahoma City, staff geologist for Conoco, will succeed Mr. Peyton as Oklahoma City division geologist.

R. S. DOUGLASS has been appointed superintendent of the Shell Oil Refinery at Norco, La., to succeed L. T. Wilson who has been named manager of the Montreal refinery at Shell Oil Co. of Canada. For the past nine years Mr. Douglass has been assistant manager of the manufacturing engineering department in Shell's head office in New York.

H. E. "Ike" Lowrey

Named Continental Supply Export Manager

H. E. "Ike" Lowrey has been appointed manager of the export division of Continental Supply Co. with headquarters in New York city at the company's export office.

Mr. Lowrey has been associated with Continental since 1935 and for the last three years has served as manager of Venezuelan operations.

Julio Zumeta, former export manager, has been named export sales manager and will direct his attention to sales and engineering functions throughout the company's extensive foreign operations.

L. B. Murray replaces Mr. Lowrey in the Caracus office as manager of Venezuelan operations and will be responsible for supervision of the company's business in the countries of Colombia, Peru and Ecuador. For the last year he has served as assistant in that position.

New Chemical Cementing Material

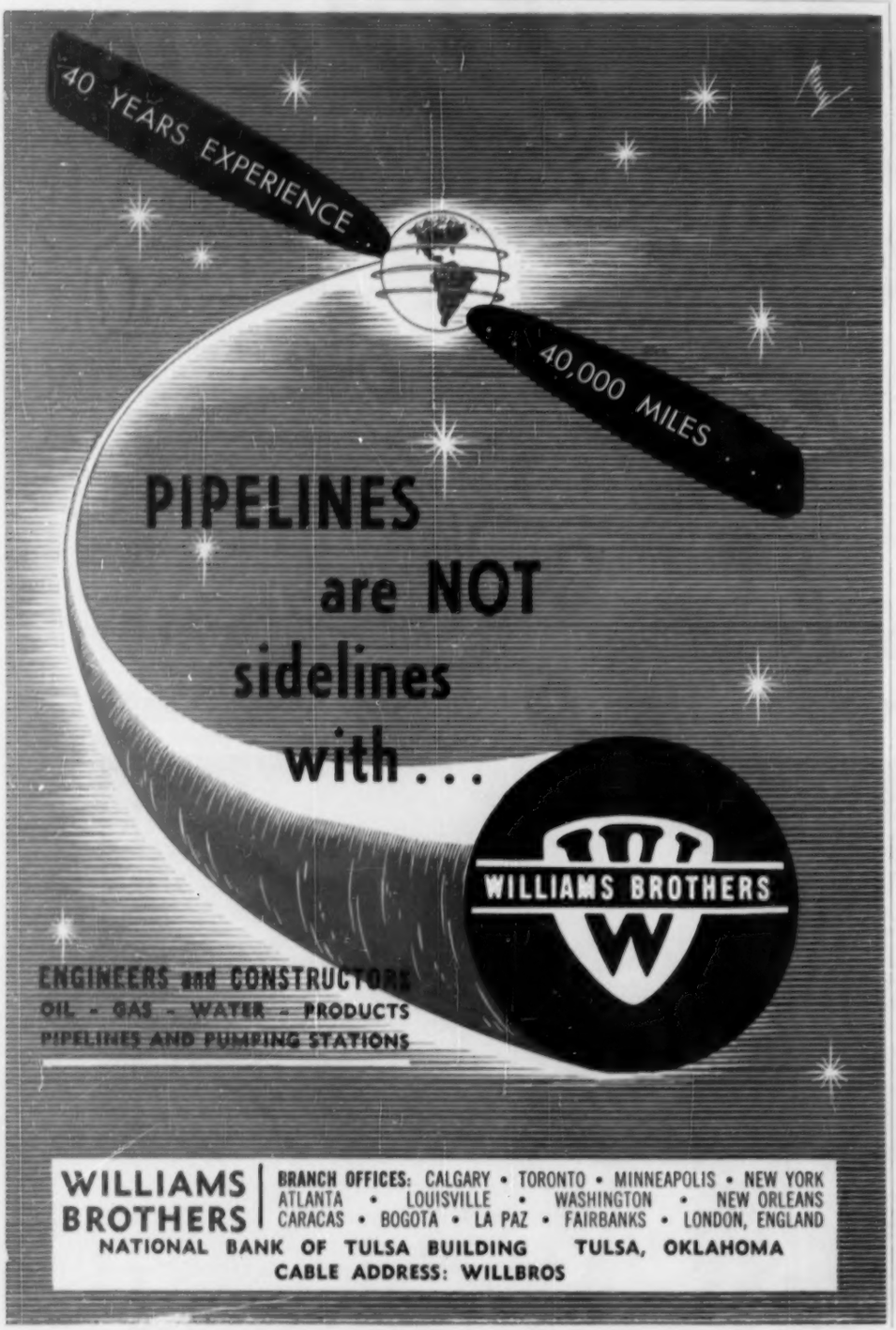
After field testing in more than 40 wells, Dowell, Inc. has announced the development of a new and important specialized chemical cement for oil and gas wells in critical areas. The new cement is being introduced by Dowell in a limited area in the southwest at this time but will be made available elsewhere as supplies and equipment are manufactured on a larger scale. Heretofore, Dowell has offered cementing service only in Ohio and Michigan fields.

Dowell's new cement was developed in its Tulsa research laboratories in an effort to overcome some of the difficulties encountered when other materials, which all incorporate Portland cement, were used in critical zones. The new product, Dexet, incorporates an aluminous material, a phosphoric acid solution and a fluoride compound added as an accelerator. The various materials are readily mixed and the low viscosity slurry pumped into a well with standard equipment and conventional procedures.

Reactions between the chemicals result in the formation of insoluble monolithic compounds. It is claimed by Dowell that there is no shrinkage when the cement sets, that it has a high bonding strength and resistance to shattering. The cement is said to tolerate relatively great contamination by drilling fluids and to assimilate or cement filter cakes. Slurries are quite uniform and setting time can be controlled at various temperatures by changing the fluoride content of the slurry.

Dexet sets with a small temperature rise. As a result setting time may be extended to provide adequate time to complete cementing jobs properly. Temperature ranges in which Dexet now is effective range from 130 to 200° F.

Tests have shown that Dexet sets through filter cake and gives a good bond without cake removal. Bonding strength is three times that of mixtures based on Portland cement. It can be used in certain areas where brine, sulfates and oil soaked formations prevent successful Portland cement jobs. Mud additives have no effect on the cement. It is noncorrosive to pipe. Compressive strength is high even with 20 percent mud contamination. Channeling is minimized because of the ability of Dexet to set filer cake.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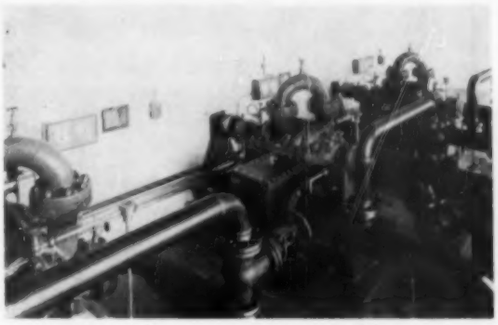
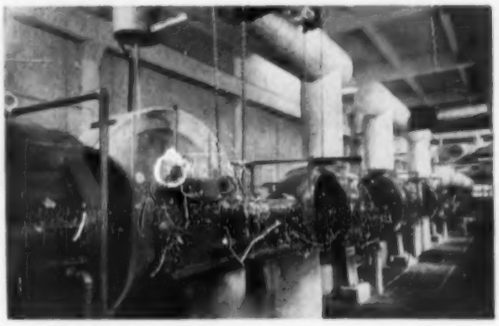
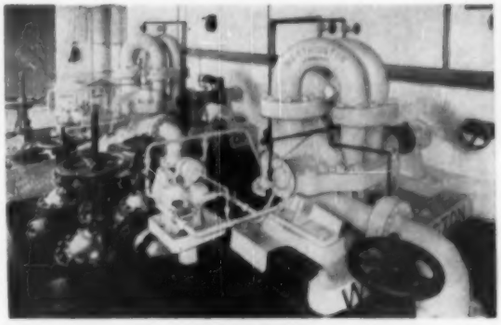


Turbines driving feed water pumps



Pipe-Line pumps



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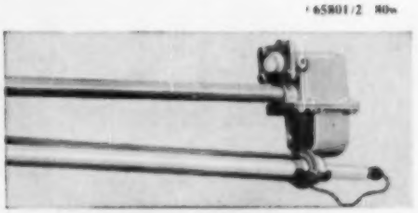

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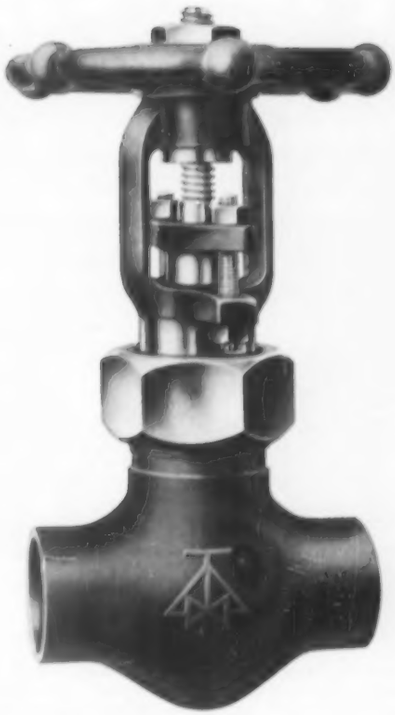

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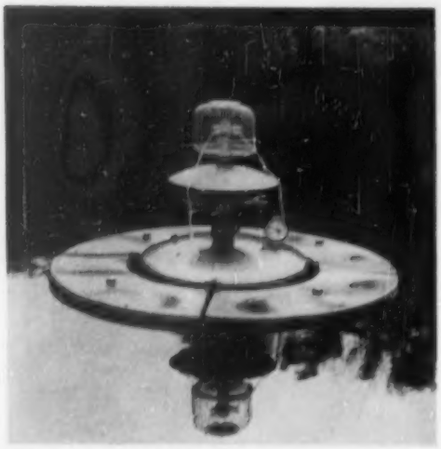

Shown is a device for fighting fires in oil or gasoline tanks. It floats on the surface of the liquid and goes into action automatically as the fire starts. Vaporized liquids with a methyl bromide or chlorobromonethane base are sprayed from revolving jets. The method is said to be capable of bringing fire under control within seconds. Manufacturers are National Fire Protection Co., Feltham, Middlesex, England.

First Synthetic Glycerol Plant in Europe

A new synthetic glycerol plant is scheduled to be built at the Pernis refinery of the Shell group near Rotterdam, Holland, and will be the only one outside the U.S.A. It will cost £2.5 million and is expected to be in operation towards the end of 1957.

Research work by Shell at Emeryville, Calif., led to the construction of that company's plant soon after the war, and this plant has been in operation for several years. Plans are now being made for the erection by Shell of a second glycerol plant at Norco, Louisiana, near New Orleans.

International News and Notes

(Continued from page 79)

Oil Exploration in Nigeria

The Shell-D'Arcy Petroleum Development Co. of Nigeria, Ltd., has been searching for oil in Nigeria since 1937. Prior to the second world war exploration had been carried out over the whole country and as a result of these investigations it was decided to concentrate efforts in the southeastern part of the country. The war, however, broke out and operations were suspended until 1946.

In September 1946, work was resumed by a geological party, a seismic party and a gravity party, plus an aerial survey of the Niger Delta covering some 15,000 square miles. This survey, owing to the difficult climatic conditions for aerial photography, was not completed until April 1953. In November 1951, following geophysical and geological work, a first deep test was spudded in at Ihuo, nine miles north of Owerri and this was carried to a depth of 11,000 feet where it was abandoned in October 1952.

In 1954, a new well was spudded in at Nzam, on the banks of the Niger north of Onitsha. Owing to the Niger overflowing its banks for some six weeks in October/November, this well took a year to drill. During the same year, other test wells were drilled at Ogbabu, in Owerri Province at Ituk Mbang, in Calabar Province and near Benin City, the last named being the first well to be drilled in the western region. Showings of oil were encountered at Ituk Mbang and small oil indications, associated with very large volumes of water, were found near Benin City.

In the middle of 1954, Shell-D'Arcy brought in a drilling contracting firm known as "Drilvo" to appraise the oil-bearing possibilities at Akata as quickly as possible. To date, Drilvo has drilled three test wells, all of them dry.

Over 2,300 people are at present working on oil exploration in Nigeria for the Shell-D'Arcy group, with four seismic parties and three deep drilling outfits in operation.

Melilli No. 1 well in Sicily about eight miles southwest of Augusta, at spudding-in dedication June 27. This well is one of two being drilled in Sicily by Augusta Ricerche Petrolifere, S.p.A., joint affiliate of Standard Oil (N. J.) and the Italian Rasiom company (Raffineria Siciliana Olii Minerali). The other test is the Bronte well on the west flank of Mt. Aetna.

Refinery Construction Contracts Signed

The Finland, state-owned oil company Neste Oy has signed contracts with Cie Fives-Lille, France, and Mannesmann-Rohrban for the building of a £3.50 million refinery at Tupavuori according to the plans and designs of the Lummus Company. The capacity of the refinery is 700,000 to 750,000 tons of crude annually and it is designed to handle either Middle East or Russian crude oils.

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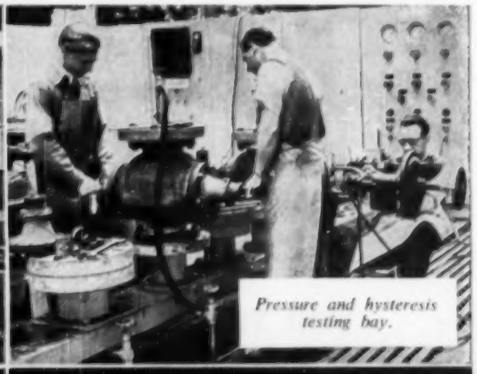
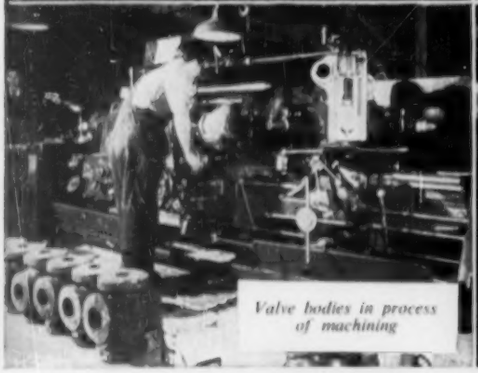
DIAPHRAGM CONTROL VALVES

LIQUID LEVEL CONTROLLERS

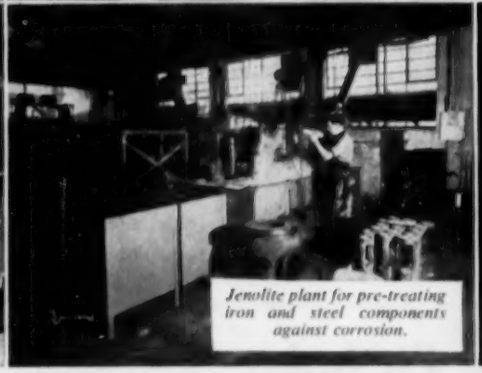
Pilot assembly and testing shop.



Pressure and hysteresis testing bay.



Valve bodies in process of machining



Jenolite plant for pre-treating iron and steel components against corrosion.

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Thermal and Catalytic Cracking of Hydrocarbons

(*Continued from page 70*)

conducive to decomposition of said acid. The portion of the catalyst is returned to the system. The contaminants on the cracking catalyst are thus substantially reduced. For regenerating spent catalyst from a suspensoid operation, R. K. Stratford and B. H. Mackenzie in 2,687,988 (to Standard Oil Dev. Co.) propose mixing the oily catalyst with hot dry catalyst, in order to facilitate fluidization of the mixture. The mixture is then stripped in a fluidizing zone, whereupon the coke is burnt in a fluid bed in another zone. In 2,695,266 or Socony Mobil Oil Co. (R. D. Drew and M. B. Tohline), a method and apparatus are given for regenerating used granular cracking material. This material associated with combustible vapors is supplied to a confined supply zone, where the combustible vapors are withdrawn at reduced pressure. The spent cracking material then gravitates to the upper section of a regeneration zone for further treatment. According to 2,702,267 of P. C. Keith (Hydrocarbon Research, Inc.), a third fluidized zone is established in a fluid cracking system between the regeneration and the reaction zone. Fouled catalyst is stripped in this third zone with regenerating gases containing hydrogen. Socony Mobil Oil Co. (L. P. Evans) in 2,701,185 and Esso Research and Engineering Co. (C. E. Hemminger) in 2,707,701 describe a kiln and a method, respectively, for regenerating spent cracking contact material.

Buys Mexican Gas

Petroleos Mexicanos (Pemex) has contracted to sell an initial quantity of 100 million cubic feet of natural gas per day to Texas Eastern Transmission Corp. over a period of 20 years. At the outset Pemex will receive from the contract an annual income of approximately five million dollars.

Texas Eastern must apply to the Federal Power Commission for a certificate for the facilities necessary to receive delivery of the gas from Pemex at the Rio Grande River, the international border.

A Decade of Oil Progress

(*Continued from page 74*)

ably will enter the picture in a more active participation.

Until then the small contractors, the tug boat owners, supply and crew boat operators, and the like, must rely largely upon the faith of engine manufacturers, ship yards and a few more daring bankers who are willing to extend credit.

Cement Standards

Publication of the second edition, Standard 10A, "Specification for Oil Well Cements," was announced today by the Division of Production of the American Petroleum Institute. Issuance of the new standard marks the first official publication of an API specification covering oil field materials as distinction from equipment. It is the result of intensive committee effort over the past four years. Testing procedure is covered in a separate publication—API RP 10B—and governs the sampling and testing provision of Standard 10A.

Fossil Spore and Pollen Study

A center for the study of fossil spores and pollen —useful in the search for petroleum has been established by New York University. Made possible by grants from the Socony Mobil Oil Co. and The Texas Co., it will be the first academic center of its kind in the western hemisphere.

Dr. Lawrence R. Wilson of the University of Massachusetts, one of the world's foremost authorities on spores and pollen, will make weekly journeys to New York from Amherst, Mass., during the 1955-56 school year to lecture and supervise the work of the NYU graduate students. The American Museum of Natural History's department of micropaleontology, which is headed by Professor Ellis, will provide the laboratory and classroom space. Instrumental in establishing the new program were Walter S. Olson, supervising geologist of the foreign producing department of The Texas Co., and Eugene Jablonski, coordinator of exploration at the Socony Mobil Oil Co. New York University for many years has offered graduate courses in animal microfossils. With the addition of the spore and pollen center, the University will have complete facilities for study and research in all phases of micropaleontology.

Gas Dehydration

The Davison Chemical Co. has issued a technical bulletin No. 201, "Dehydration of Air and Gas with Davison Silica Gel," a report on research in this field at Southwest Research Institute, at Carthage, Ill., natural gas plant and Davison laboratories. Available from the company's sales control department, Baltimore 3, Maryland.

Unifiner on Stream

A 600-b/d Unifining unit has gone on stream at the refinery of the Aurora Gasoline Co. at Muskegon, Mich., processing cracked distillates and naphthas to produce part of the feed stock for a UOP Platforming unit. Process design for the Unifining unit was done by Universal Oil Products Co., which also licensed the installation. Aurora personnel did the engineering and construction work. The Platformer started up Oct. 28, 1949, the world's first commercial unit to go on stream. The original design capacity was 1,500 b/sd, but it since has been increased to 2,500 b/sd.

Graver Publication

Graver Construction Co. has recently published an interesting account describing the construction of a complete refining section for Sinclair Refining Co. Among the problems encountered and successfully overcome was the erection of a 151 foot bubble tower in an area closely surrounded by other refining installations. The size of this installation is illustrated by the excavation required for its base, when 12,000 cubic feet of earth was removed, culminating in what is believed the largest lift of a refinery tower in Chicago.

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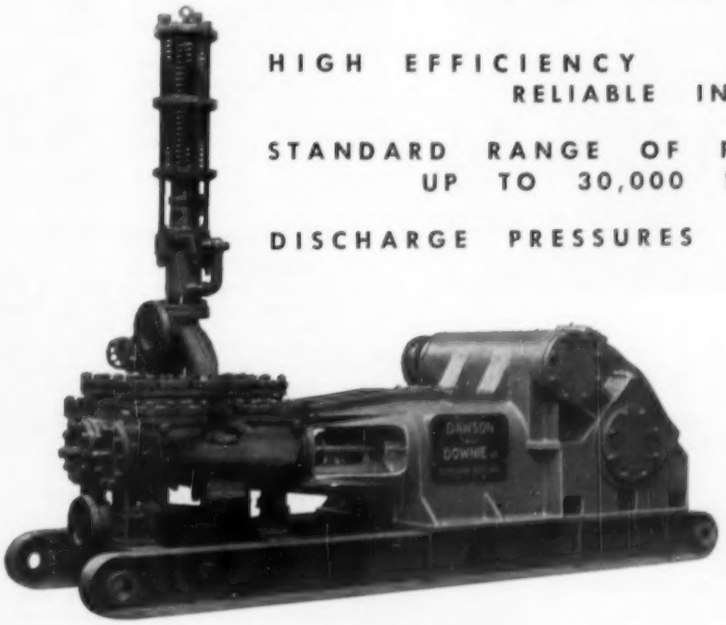

Illustration shows one of a series of pumps supplied to BRITISH PETROLEUM CO. LTD.'S refinery at ADEN, for pumping diesel and fuel oils from the refinery to the B.P. bunkering installation.

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New Development in Rubber Slurry Valves

An advanced development in rubber slurry valves is announced by Equipment Engineers Inc. of San Francisco, Calif., which gives control for abrasive and corrosive flows plus maximum abrasion resistance and remote control by compact hydraulic control units.

Unifiner Electronically Controlled

The world's first Unifining unit to be controlled electronically has gone on stream at the refinery of the Rock Island Refining Corp. at Indianapolis. The 300 b/sd unit is serving as a feed preparation section for producing additional charge to a 2,400 barrel per day UOP Platforming unit which, when it went into operation a little over a year ago, was the first complete refinery unit in the United States to be controlled by electronic instruments.

Texas Instruments New Marketing Office

An eastern region marketing office has been opened in New York City by Texas Instruments Inc. The opening of the new office is the third step in the establishment of marketing headquarters throughout the U.S. A Los Angeles office was opened in June and a Chicago office in August.

The 25-year-old electronics and geophysics firm until recently marketed its products and services primarily through Dallas-based representatives and with only a few field-based specialized representatives.

Eastern region marketing office personnel includes Jay R. Reese, semiconductor productions division district manager, C. M. Bedell and Alan S. Kumble, components division sales engineers and W. V. McGalliard, apparatus division service engineering representative.

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Oil Company Earnings

Net income of 44 oil companies in the first nine months of 1955 totaled $2,072 billion compared with $1,745 billion in 1954, an 18.7 percent increase.

Details by companies follow:

NINE MONTHS NET INCOME

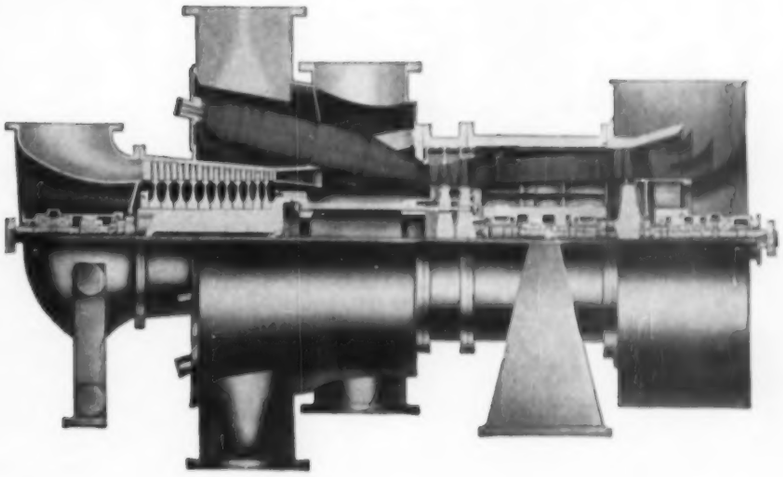
	Thousands of Dollars		Per Share Of Common	
	1955	1954	1955	1954
Amerada	$ 18,017	$ 11,657	$2.86	$1.85
Anderson Pritchard	3,216	2,535	3.95	3.12
Ashland Oil	7,257	5,235	1.11	.72
Atlantic Refining	23,944	23,944	2.61	2.84
Barber Oil Co.	14,445	711	—	—
Bishop Oil Co.	274	160	.51	.42
Chicago Corp.	5,323	3,429	1.27	.96
Continental Oil	34,455	31,337	3.53	3.22
Cities Service Co.	32,518	30,911	3.28	2.69
Creole Petroleum	220,159	173,224	2.84	2.28
Crescent Corp.	2,168	2,241	—	—
Gulf Oil	145,287	121,867	5.68	4.76
Honolulu Oil	10,328	8,129	2.75	2.17
Houston Oil Co. Tex.	5,109	4,308	3.76	3.23
Inter. Pet.	24,600	10,000	1.69	1.24
Imperial Oil Co.	42,522	41,235	1.42	1.38
Louisiana Land & Ex.	3,460	3,746	1.16	1.26
Maracaibo Oil Expl.	260	341	.52	.69
Middle States Pet.	831	1,276	—	—
Ohio Oil	29,193	28,281	2.22	2.15
Pacific Western	3,383	5,276	.57	.93
Panhandle	11,621	658	3.33	.41
Phillips Pet.	65,189	55,615	3.80	3.80
Pure Oil	24,650	20,829	2.82	2.36
Plymouth Oil	5,210	4,930	2.16	2.05
Quaker State Oil	1,918	1,480	2.32	1.79
Richfield Oil	22,665	18,278	5.67	4.57
Shell Oil	85,646	89,545	3.11	3.26
Seaboard Oil	5,105	5,345	1.40	1.46
Sinclair Oil	56,138	52,896	4.24	4.29
Skelly Oil	22,815	20,933	3.97	3.64
Socony Mobil	145,000	128,000	4.14	3.65
Standard of Calif.	166,272	154,921	5.52	5.15
Standard of Ky.	9,546	9,544	3.66	3.66
Standard of N.J.	523,000	438,000	7.99	7.23
Standard of Ohio	16,306	12,385	3.91	2.93
Sunray-Midcontinent	27,535	—	—	—
Superior Oil	4,063	8,343	9.62	19.76
Tide Water Assoc.	27,256	26,967	2.18	2.01
The Texas Co.	189,767	151,880	6.91	5.53
Texas Gulf Prod. Co.	5,438	3,813	1.48	1.04
Union Oil Co. Calif.	25,094	27,151	3.73	3.98
Universal Cons. Oil	1,407	1,201	2.20	1.88
Venezuela Pet.	3,350	2,407	.83	.60
Wilcox Oil Co.	673	437	2.39	1.56
TOTAL	$2,072,413	$1,745,401		

Oil Company Stock Change

W. K. Whiteford, president of Gulf Oil Corp., and W. K. Warren, chairman of the board of directors and chief executive officer of Warren Petroleum Corp., announced in November that an agreement has been reached between Gulf Oil Corp. and certain major stockholders of Warren Petroleum Corp., covering the basis for the exchange of Warren stock for stock of Gulf Oil, on a basis of eight-tenths of one share of Gulf stock for each share of Warren stock.

New Houston Technical Laboratories Plant

Construction has begun on the new main plant for Houston Technical Laboratories, Texas Instruments geophysical instrumentation subsidiary, TI president J. E. Jonsson has annuonced. The 40,000 square foot completely air conditioned building is being built on a five-acre tract on Buffalo Speedway in Houston. When the modern new building is completed next spring, HTL will be able to consolidate its research, design and manufacture operations now being carried on at 2424 Branard and several rented buildings in Houston. Houston Technical Laboratories is the petroleum instrumentation division of Texas Instruments Inc., Dallas.



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You're looking at a cut-away view of a Westinghouse 5000-hp gas turbine. This is one in a complete line of Westinghouse gas turbines, ranging from 1800 hp (1250 kw) to 20,000 hp (15,000 kw), which are providing more economical power for industry throughout the world.

In eastern Venezuela, for example, Westinghouse gas turbine-generators are turning natural gas into *power* for oil fields of the Mene Grande Oil Company. And in Spain, another unit, because of simplicity of installation and operation as well as quick availability, will soon permit a leading metal rolling mill to go to a continuous work week despite local power shortages.

Can the Westinghouse gas turbine help *you?*

Yes, it can, if . . .

- Water is scarce
- Or natural gas is readily available
- Or you need a pipeline pumping or quickly-operable stand-by power generation unit
- Or you can use exhaust gas for feed heating, steam generation or process
- Or you need additional installed capacity quickly.

For more information on the Westinghouse gas turbine and its applicability to your needs, write to me on your company letterhead for one or both booklets: BW-5859, Gas Turbines for Mechanical Drive Applications; BW-5887, Gas Turbines for Electric Power Generation.

N. F. Emig

N. F. Emig, *Supervisor*
Steam Section

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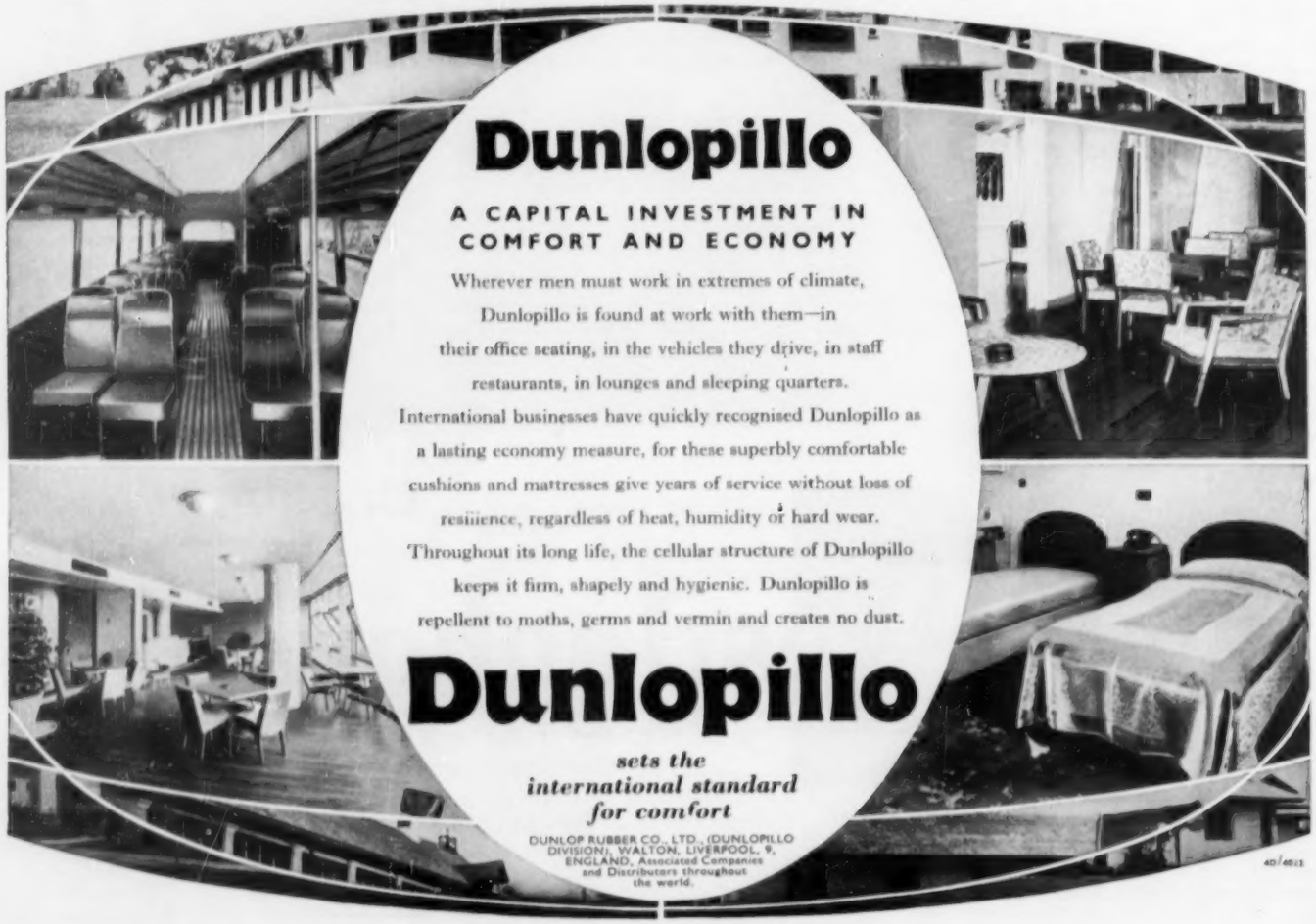
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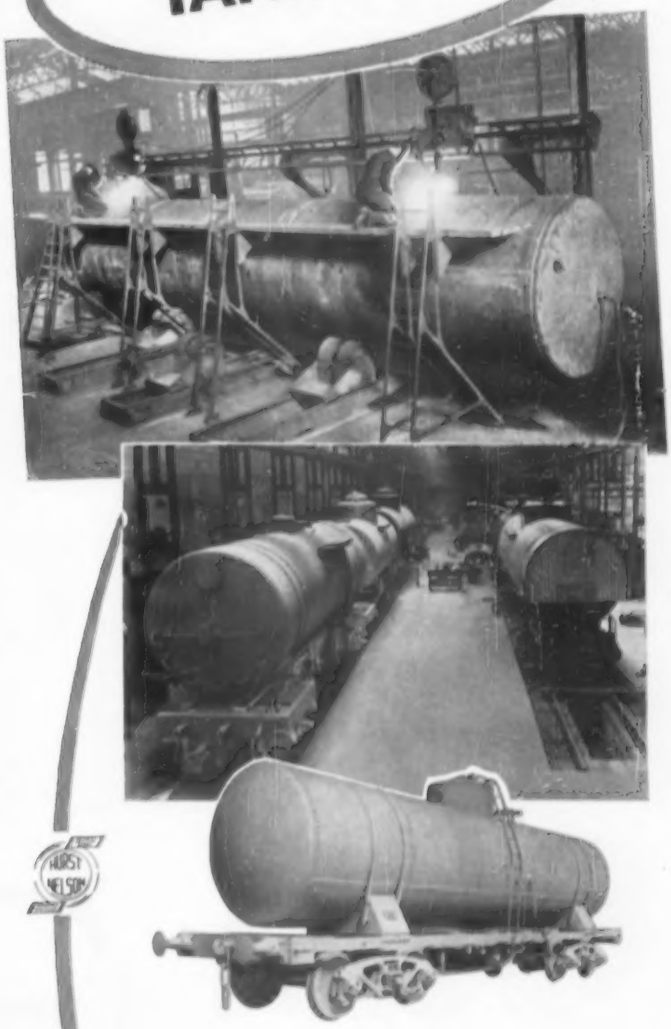

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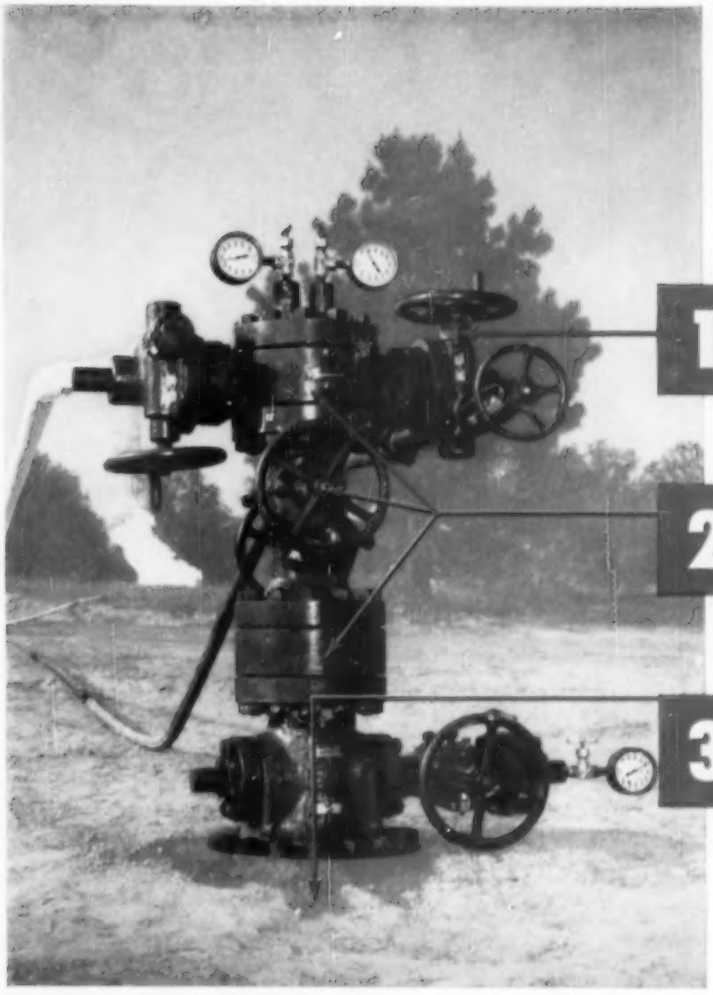

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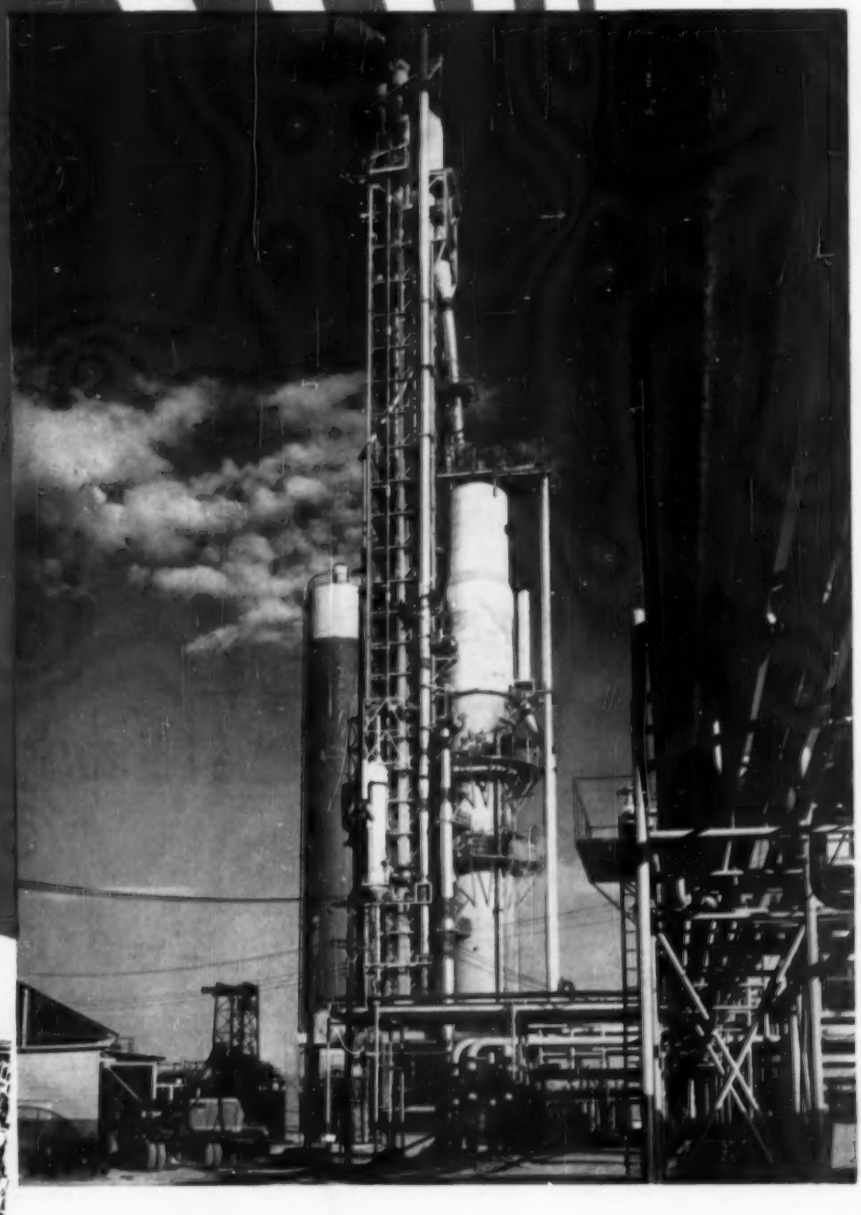

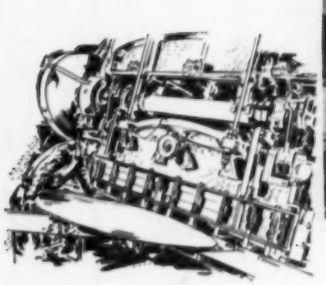

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